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World Petroleum

FEBRUARY 1957

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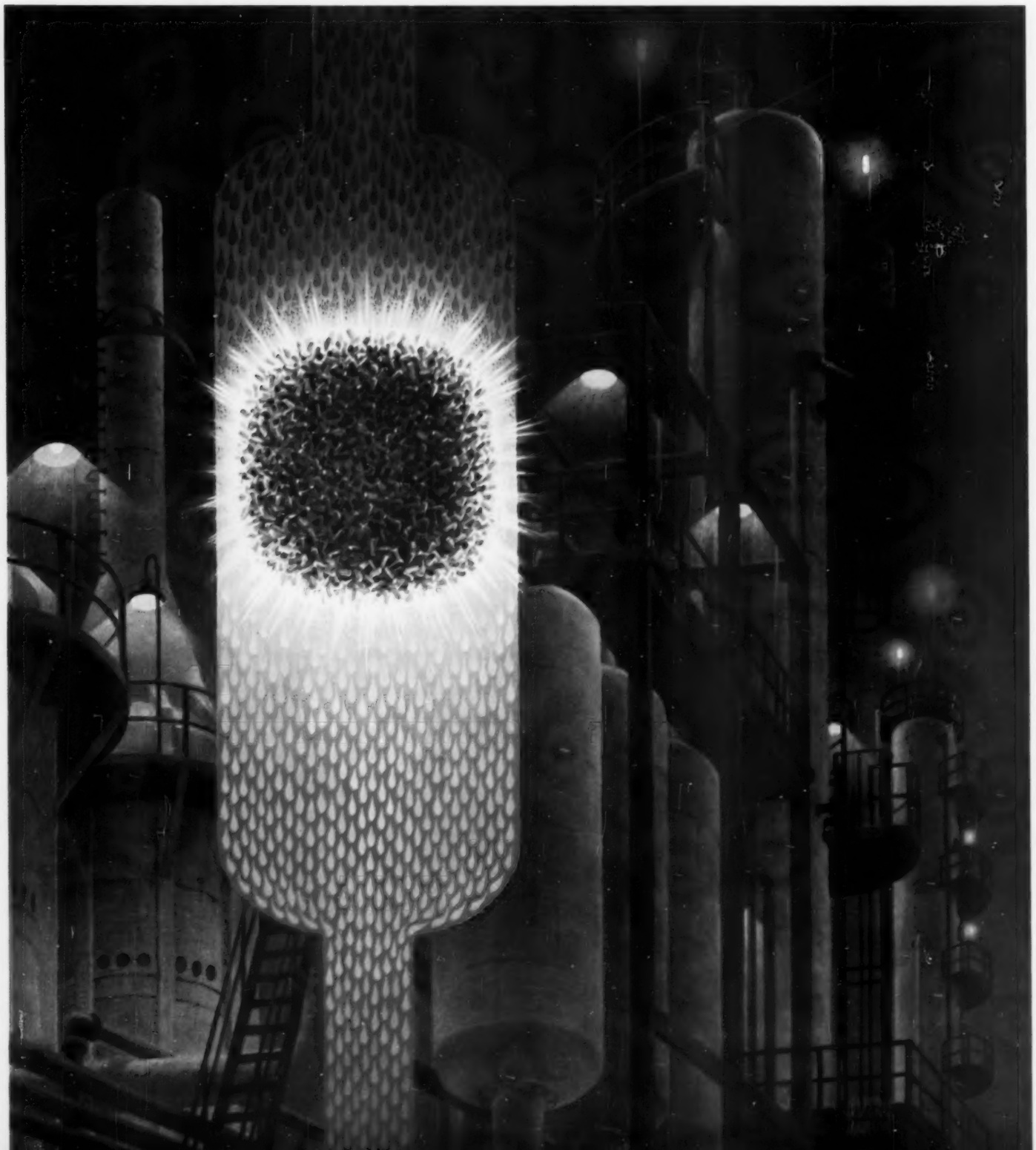

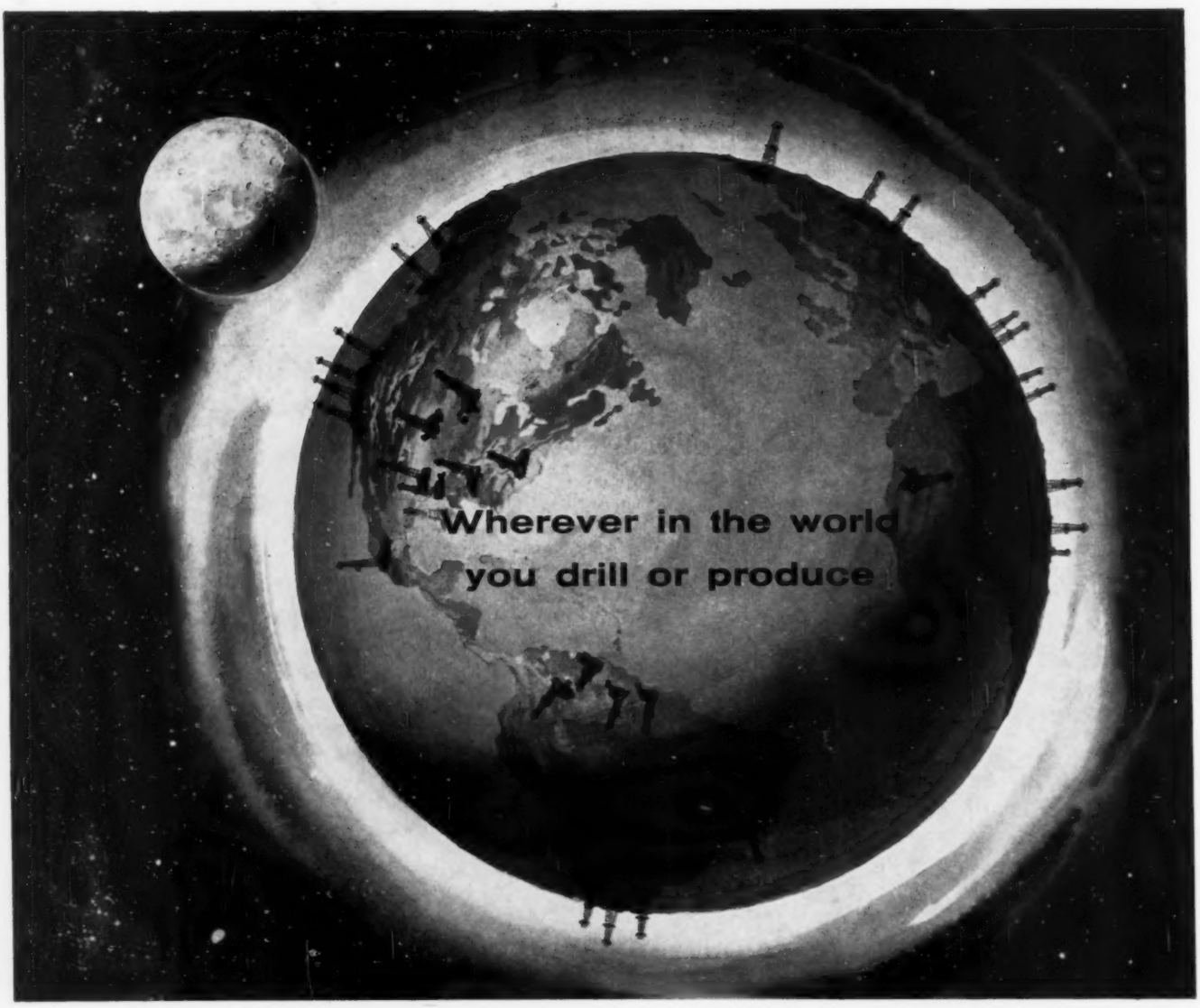

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Tracing the path of fuel with carbon-14

Ethyl Research tags 1 in 100,000,000 atoms with radioactive carbon for a better picture of distribution in the cylinders.

by D. E. COOPER

Ethyl Corporation, Detroit, Mich.

The distribution of fuel components and fuel additives to the cylinders of multicylinder engines is of prime importance to the petroleum industry. Just as a chain is only as strong as its weakest link, so is an engine's performance limited by the one cylinder which does not continuously get its proper dosage of high-octane hydrocarbons or of tetraethyllead.

The goal of engine designers is the creation of an engine wherein the fuel/air ratio, hydrocarbon composition and additive concentrations are identical for each cylinder of a multicylinder engine. Fuel injection—now becoming commercially available—represents one approach to the solution of this difficult problem.

Whether fuel injection or carburetion is employed, however, an accurate knowledge of fuel and additive distribution in engines is necessary to assure optimum use of the gasolines the refiner is producing today.

A continuing study

As is the case with most of Ethyl's other basic research studies, the study of fuel distribution has been a continuing one. Some years ago, a glass manifold was installed on an engine, and motion pictures were made of flow patterns, giving some insight into the quantities of fuel mixture fed to various cylinders.

A second step in Ethyl fuel distribution studies involved the tagging of specific hydrocarbons with deuterium or heavy hydrogen. One component (the cyclopentanes, for example) had a specific number of hydrogen atoms replaced with heavy hydrogen. This special fuel was then burned in the engine. Samples of the exhaust gases from various cylinders were condensed and analyzed in a mass spectrometer to give a picture of the distribution of that particular hydrocarbon among the cylinders of the engine on test.

This technique required, however, that the ratio of heavy hydrogen to normal hydrogen be at least 1 to 100 and thus ruled out studies of additive concentrations, which are much smaller.

Tagged carbon atoms

A third step in this continuing program of fuel distribution studies has involved switching from a stable isotope such as deuterium to a radioactive one such as carbon-14. Now it becomes possible to tag tetraethyllead with carbon-14 and measure its concentration in an engine cylinder accurately, even though only one tagged atom is present among 100,000,000 normal carbon-12 atoms!

All of these distribution studies involved the use of a quick-opening (1/1,000 second) sampling valve. This valve samples the contents of a particular cylinder. It is screwed into the spark-plug opening and combines the valve with spark-plug electrodes.

Gas samples from the test engine are bubbled through absorbing solutions of barium hydroxide. The carbon dioxide is regenerated and transferred to an ionization chamber, where its beta activity is measured by a vibrating-reed electrometer.

And now . . . tritium

The newest refinement in this study consists of the replacement of carbon-14 with hydrogen-3 or tritium as the radioactive tracer element. The use of tritium simplifies and makes less expensive the preparation of tagged hydrocarbon or additive molecules for study. It also simplifies the exhaust-gas-sample collection technique. A scintillation counter is used to study the tritium-containing condensate from the cylinders.

As is the case with all of our basic research studies, the information from this continuing study of fuel distribution is available to the petroleum industry. We would be happy to discuss any particular aspect of this problem with you in your office. We would also be happy to have you visit our Detroit Laboratories to see this equipment and discuss it with our technical personnel. In either case, contact your local Ethyl representative for an appointment.

What Ethyl Research offers you

Ethyl Research is in the unique position of serving both the petroleum and automotive industries.

In that capacity, we have contributed much in the field of fundamental as well as applied research. Today at our laboratories in Detroit we are conducting studies on the distribution of fuel components and fuel additives to the cylinders of multicylinder engines.

Searching for answers to these basic problems has led us to develop many new instruments and new techniques. The information which we have developed from our research efforts is being constantly circulated throughout both the automotive and petroleum industries to help them with their research.

If you desire any information concerning fuel-engine problems, just contact your Ethyl representative.

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M-3 Guns Shoot 1268 Holes in Four Hours

Firing an average of 317 bullets per hour in this shallow Oklahoma well is an outstanding record of perforating speed and efficiency.

McCullough 4¼" O.D. M-3 Bullet Guns fired 1268 improved ½" Ogival Bullets in 7" O.D. cemented casing in two intervals from 1040' to 1064' and from 2762' to 2790'. This was a salt water disposal well. Operator was well pleased.

Speed like this can only be accomplished by experienced, thoroughly trained crews and by using simultaneous firing M-3 Bullet Guns—fastest, most efficient method of bullet perforating available.

M-3's Succeed After Two Others Fail

Two other service companies attempted to perforate this Montana well without success. One was unable to accurately locate the collars and perforated the water zone. The other was unable to do the job because the shots were in dry hole and incoming pressure moved their gun up the hole.

Within 1½ hours, McCullough moved in on the job, located the zone to be perforated, fired 32 improved ½" Ogival Bullets in 5½" O.D. casing between 3955' and 3963' with 3½" O.D. M-3 Bullet Guns, tore down and moved off. Results good—operator happy.

This is just one more example of the accuracy of McCullough measurements and of the value of simultaneous firing M-3 Bullet Guns.

Superior Penetration Pays Off ...Fracturing Job Successful

Hard Shooting M-3 Bullet Gun Permits Successful Completion of Sandfrac Job...Penetrates Tough Formation After Other Bullet Gun Failed.

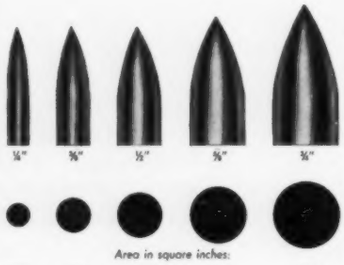
Previously perforated by another service company, the operator was unable to fracture the formation in this Illinois well; pressures up to 4000 psi were reached without results.

McCullough was called to re-perforate the well with 4⅛" O.D. M-3 Bullet Guns firing improved ½" Ogival Bullets. Twenty shots were fired through 5½" 14 lb. J-55 cemented casing in a five foot interval from 2833' to 2838'.

After perforating by McCullough the well "broke down" at 1600 psi and took fracturing material at the rate of 350 gallons of oil and 700 pounds of sand per minute. This well is now flowing—one of the best in the field—and the entire perforating job, including rigging up and tearing down, required only 1½ hours rig time.

The superior firing power of M-3 Bullet Guns; the deep penetrating qualities of improved Ogival Bullets are particularly valuable where tough, tight formations must be fractured for good production.

There are many jobs like this on record, where the superior penetrating power of McCullough M-3 Bullet Guns has successfully completed the job after others failed. Next time, be sure of results—call McCullough first.



Improved McCullough Ogival Bullets are designed for maximum piercing ability. Type and quality of steel, heat treatment, weight, shape, sharpness of point, etc. are all carefully controlled factors in their production. They are the deepest penetrating bullets known.

Bullet sizes shown above are standard. Burrless caps are available to fit all standard sizes. Special sizes and types, such as the 1/16" and 1/8", are available to meet unusual requirements.

Do you want to see how other oil men have benefited by using McCullough M-3 Bullet Guns? Send for your copy of "RESULTS"—field reports of outstanding jobs successfully completed by M-3 Guns.

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ANSUL

Washington PIPE LINE

by Joseph Huttlinger

Marketing Investigations

The coming of price rises for crude oil, then fuel oil and gasoline, was the signal for a number of attacks on oil and oil men by Congress.

Senator Hubert Humphrey, (D., Minn.), who has investigated oil marketing from his post on the Small Business Committee, called the price increases "rank opportunism" and defiance of the laws of supply and demand. He asked the Attorney General to investigate.

Senator Margaret Chase Smith, (R., Me.), asked the federal government to move, if necessary, "to prevent a fuel-oil price gouge."

Senator Joseph C. O'Mahoney, (D., Wyo.), asked an investigation of the entire oil lift to Europe, and of the 15 major US oil companies in the Middle East Emergency Committee.

A four-way study of oil became certain, in fact, when the Department of Justice said it was studying the chance of "collusion" in the oil-price increases; the American Automobile Assn., representing the general public, objected; and segments of the industry, including oil marketers, gasoline dealers, and independent refiners objected to the crude-oil increases at a time of adequate, or surplus, oil products.

The climate of opinion stemming from the oil-price studies is bound to have a harmful reaction on other matters of importance to oil and gas, and oil's battle on these matters, sure to be up in the coming session of Congress, becomes harder by virtue of the fact oil is in low esteem with the public for a number of reasons. While price hikes are one of them, the President's crack at "arrogant lobbying" a year ago in vetoing the gas bill is another. The sting is not taken from the President's remark by a "progress" report on lobbying by Senator John L. McClellan (D., Ark.) that he has found no "body of evidence" of improper conduct by oil and gas.

On the bright side, President Eisenhower, himself, called for a new natural-gas bill in his budget message.

The other bright spot lies in the field of the depletion allowance. Secretary of the Treasury George Humphrey, who a year ago endorsed the idea of depletion provisions in the tax laws for oil and gas, and minerals, this year backed up the level of 27.5% which is given to oil and gas, saying "as a practical matter, it looks as if this was working out about practically." That seemed to put the administration on the side of those for retaining the provision where it is. This will be important, as new attacks are due in coming months in Congress.

The problems of gasoline marketing are due for an airing before Congress and the courts in the coming months. In fact, the airing already is under way.

One problem has to do with "fair trading" of gasoline, a system whereby the refiner suggests the price at which the retail dealer shall sell the gasoline. This system is warmly approved by dealers and by many refiners, and it has been regarded as legal under special action of the US Congress when states permit this kind of selling. Senator Hubert Humphrey (D., Minn.) says the coming of fair trading has ended New Jersey gasoline price wars.

A second problem revolves upon the action the Congress could, or should, take to answer pleas of many gasoline dealers for relief from present problems. In response to the pleas, Representative James Roosevelt (D., Calif.) has introduced legislation calling for refiners to own no retail stations, although he would permit jobbers to own them; to forbid all pressure by major oil companies on dealers to handle specific types of tires, batteries, and accessories; for US financing of court suits in equity by dealers against their suppliers in certain instances; and to give the dealer the right to sue the supplier in case of cancellation of a lease. Mr. Roosevelt plans hearings on his measures about April.

The fair-trade system, offered by major oil companies in the East last summer, in a desperate effort to end disastrous gasoline price wars, is finding disapproval in the courts.

At Boston, Mass., a US District judge ruled that Esso Standard Oil Co. cannot enforce its fair-trade contracts; that, if a dealer wants to undercut the suggested fair-trade price, the dealer can go ahead and do so. Esso has gone to the Court of Appeals, with the final outcome in doubt, but decision expected in the spring or the summer.

The Esso opinion was on the grounds that Esso, as a supplier of commercial accounts, at times is in competition with the dealer; and thus the fair trading does not apply. Fair trading, the court said, is vertical only, not horizontal.

A more sweeping attack on fair trading of gasoline comes from the US Department of Justice in a Boston case involving Socony Mobil Oil Co. After DJ accused the company of a conspiracy to fix gasoline prices, Socony offered the fair-trade defense. DJ wrote a 70-page brief giving its position, for the first time, that fair trading does not apply to gasoline which, it said, is not a "bulk" commodity, not sold in a "container," and does not carry a "trademark." All these are needed, said DJ, if fair trading is to be legal.

At the same time The California Co. (CALSO) is in the courts in New Jersey trying to enforce its fair trading of gasoline, against a handful of dealers who have undercut the suggested price. All in all, the chances are there'll be court decisions soon on fair trading of gasoline. But to lawyers watching developments, the signs are that fair trading of gasoline has a "bleak" future.

If so, this may lead to more price wars and, thus, more steam behind the drive for legislation backed by gasoline dealers. One bill, the Kefauver-Patman "good faith" measure, would forbid "price discrimination" in such a way that majors would be handcuffed in trying to set prices to compete with other majors. This bill is seen as a major threat to oil companies.

New Rotary-Rig Tax Ruling

A rotary drilling rig may be depreciated for income-tax purposes on the basis of the number of days it operates, the Internal Revenue Service has just ruled. The same goes for other equipment where wear and tear arising from use, and not old age, determine the depreciation, or life span, of the equipment.

Usually depreciation is on the basis of the number of years of active service of equipment. To work on the operating-day method, an estimate must be made of the total number of days the equipment can be operated. Then the depreciation is worked out on the basis of the number of days used. One using this also must establish a reasonable salvage value, and show this results in a reasonable annual allowance for depreciation. Also, advance permission should be obtained.

Refining Dividends One Billion

Oil refining companies paid out almost a billion dollars ($937,500,000) in publicly reported cash dividends during the first 11 months of 1956, it is reported by the US Department of Commerce. This compares with $827,200,000 in the first 11 months of last year.

For all manufacturing industries, the total in the first 11 months of 1956 was $4,767,900,000, compared with $4,100,500,000 in the same period a year earlier.

250 Pipe Firms

The fabricated pipe and fittings industry is made up of 250 firms, with total employees of 12,670, the US Census Bureau reported in December.

The value added by manufacture during 1954 came to $123,028,000, more than double the figure of 1947, which was $58,786,000. In the earlier year the total of employees was 10,568.

The industry is described by census as representing "manufacturing establishments primarily engaged in cutting, threading, bending, and otherwise fabricating pipe and pipe fittings from purchased pipe."

The 1954 figures show that some 130 of the firms had 20 or more employees; that the payroll in the year came to $62,092,000; that the total of production workers was 9,943 working a total of 19,352,000 manhours, for wages of $43,945,000. The cost of materials was given as $102,871,000, and capital outlay $4,804,000. The total of shipments came to $214,133,000 during 1954, a figure which includes interplant transfers; the comparable figure for 1947 was given as $109,991,000.

Depletion Allowance Discussed

The income-tax depletion provision for crude petroleum and natural-gas production is being opened up again—this time by the oil industry itself.

Union Oil Co. of California, backed by officials of most of the chambers of commerce in Colorado, came to Washington during January to seek a 27.5% depletion provision for oil made from oil shale. Under the tax laws, such shale would receive a maximum of 15%.

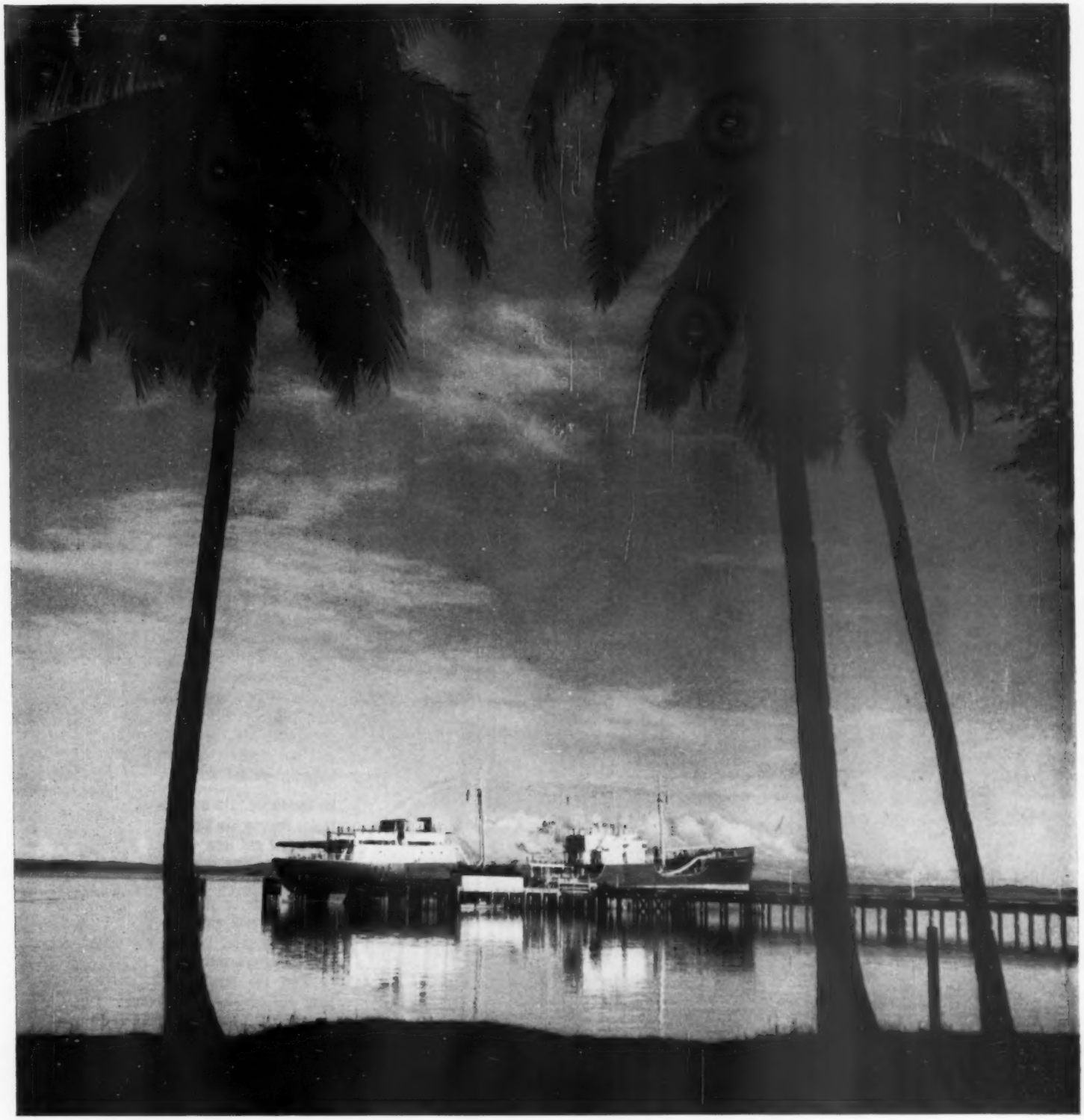
A. C. Rubel, Union's president, told a delegation of western state congressmen the technical part of shale-to-oil is nearly solved, and in the next 6 months he can work out a paper plan for a commercial plant with a capacity of 25,000 b/d to 30,000 b/d. A pipeline would carry the oil to the West Coast. Total investment might be $300 million.

The economics of all this points toward use of oil shale for oil soon, he said, but he wants the same tax treatment for shale as for oil from oil wells. A check with oil companies with shale reserves, he said, indicates they are with him. He named Standard Oil Co. (California), The Carter Oil Co. (a subsidiary of Jersey Standard), Tidewater Oil Co., Gulf Oil Corp., and Shell Oil Co.

The oil-company president and the chamber officials talked up a change in the tax laws for shale with top officials of the US Treasury and Navy Departments, Bureau of Mines and, others. As they dug into Washington reaction, they saw ahead "a long, hard fight."

At least one problem lies in the attitude of the coal industry. Colorado coal interests, for instance, want 27.5% for coal if it is given to shale; and, if pressed, this could kill off the help for shale. Another problem is the attitude of the bulk of US oil producers who may fear competition from shale. Treasury Department says oil from wells gets 27.5% because you have to find that oil, but you know where the shale is.

While the fight for tax aid for shale seems uphill, the attempt indicates the day may be close when the shale comes into use on a commercial scale. This could be important. Senator Joseph C. O'Mahoney (D., Wyo.), for instance, said, "the shale of the West is capable of giving more oil than all of the Arabian peninsula."



"Change is a law of life. But what is disturbing is evidence now and then of a drift backward to the old notion that agreements are merely scraps of paper. The world cannot be organized for its own good on any such foundation of irresponsibility. We must be able to rely upon each other's word. There is no other principle on which people and nations can work together for progress and their mutual benefits."

– Eugene Holman, Chairman of the Board, Standard Oil Company (New Jersey)

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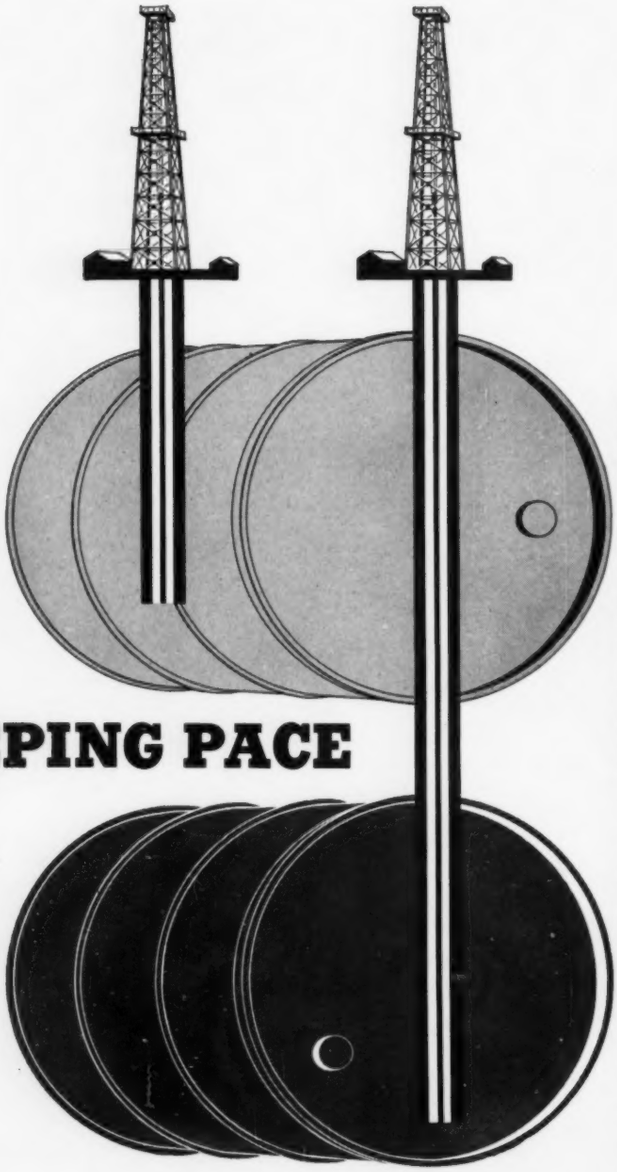

KEEPING PACE

Drills were chewing their way down for about 2000 feet in the search for oil in 1916. Today's drilling depth is more than double that.

The change in drilling that forty years has brought well symbolizes many advances in the petroleum and chemical industries. Engineers have dug more deeply into the secrets of nature, too . . . have designed plants and processes to wrest new products and services from petroleum, ores and elements.

We mentioned 1916 because that is the year Sun Ship was founded. It has long served the swift-growing needs of petroleum and chemical industries. Year by year, the engineering skill and facilities of the great Sun Ship plant have proven their ability to meet the demands for plant and equipment keyed to the swift pace of progress in these and other important fields. Sun Ship keeps pace with progress.

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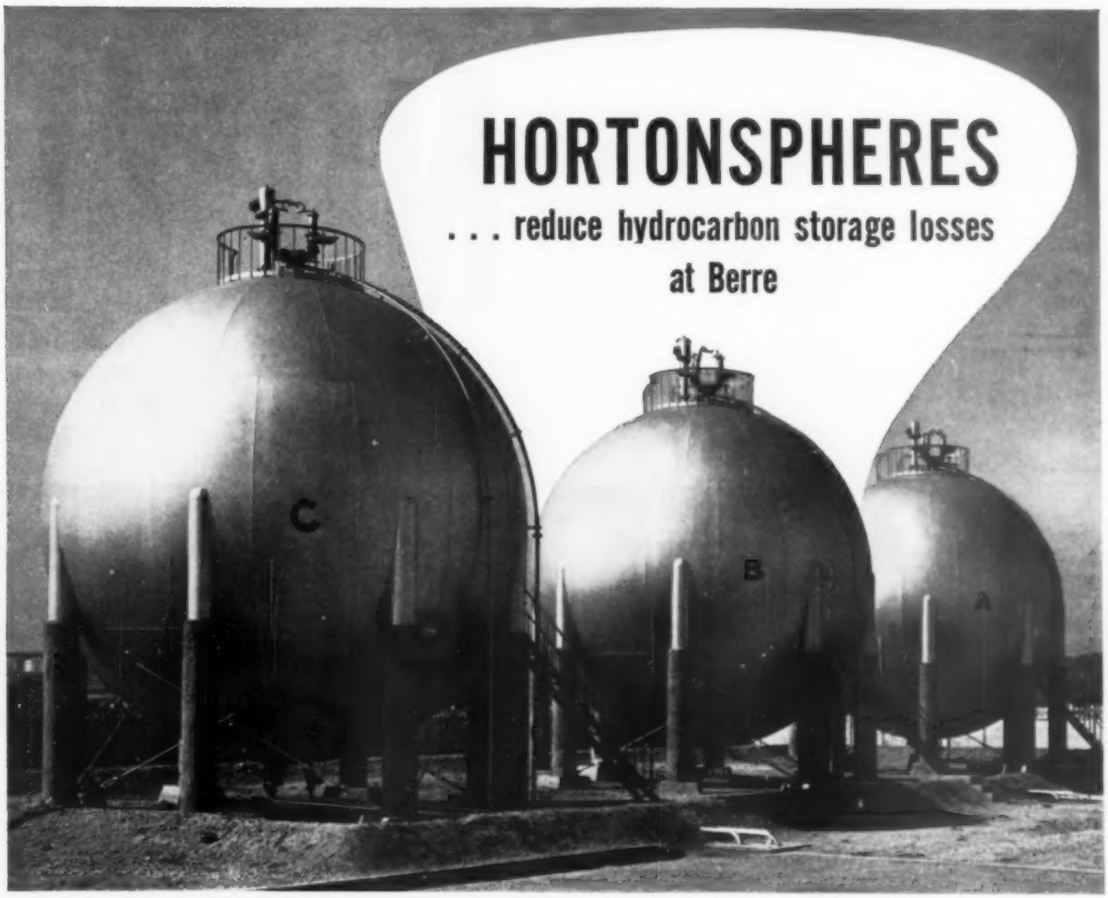

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ATLANTIC

Canadian Notes

Natural-gas and oil pipelines were still making most of the news in British Columbia's petroleum industry as the new year began.

For the first time in history the populous lower mainland regions of the province have been hooked up to a natural-gas distributing system. New Westminster, 10 miles east of Vancouver, was the first city in BC to get natural gas, hooking into the Pacific Northwest Pipeline's line at the international boundary at Huntington.

Gas from the Pacific lines will be used until the Westcoast Transmission 650-mile pipeline from the Peace River districts of BC and Alberta is completed next November.

In the meantime Trans Mountain Oil Pipe Line, which pipes oil from Edmonton, is rushing plans to increase the capacity of its line to Vancouver and the Pacific Coast. At the year's end the line capacity was 200,000 b/d. Canadian Bechtel is at present making a detailed engineering study of the line to raise its throughput to 300,000 bbl, and is at present building 2 additional pumping stations for Trans Mountain at Jasper and Gainsford in Alberta.

Increased offshore tanker shipments from the Trans Mountain shipping docks on Vancouver Harbor have brought about the need for continued expansion of the line. Until the end of November 40 tankers had been loaded at the dock, for export.

In order to carry the increased load, the line will be looped. This will be done by having an extra line between pumping stations, where the grade is difficult. One line would be unable to overcome the pressure needed to move the 300,000 bbl.

Since the increased throughput of the line, rumors have been persistent that another line will be built. D. M. Morrison, Trans Mountain president, says this is still a long way off.

The rumors, however, can't be discounted, as most refineries in the state of Washington are supplied by the Trans Mountain line. The ones now in the planning stage will draw from the same line. Latest of these is a $65 million refinery planned for Everett, Wash., by Standard Oil Co. of California.

Capacity of this plant, which will be built on 2,400 acres owned by Standard, will be between 60,000 b/d and 100,000 b/d. This plant alone could use almost the entire increase in the Trans Mountain line's capacity. T. S. Petersen, Standard president, said construction will not start for about a year.

In Vancouver City, appliances burning manufactured gas were all converted to natural gas for the BC Electric Co. which has the distribution franchise by American Conversion Co. In other areas not serviced by manufactured gas new pipe is being laid rapidly.

New service is being piped into Port Moody, Port Coquitlam, which are expanding through industry seeking more space away from the crowded industrial areas of Vancouver. Craig and Ralston Construction Co. and Mutual Construction have contracts for the laying of 6-in. and 12-in. into these communities.

In the meantime, more than 500 miles of main-line pipe (30-in.) have been delivered Westcoast—with deliveries averaging 20 miles per month. Work of connecting the northern BC and Alberta gas fields with the Pacific Coast area has been proceeding on schedule, with 470 miles of mainline laid by December 1.

The Huntington meter station at the USA border has been completed, and completed sections of the line are being tested.

Increasing market demands for natural gas to serve the booming BC economy resulted in a contract by Westcoast to purchase additional supplies from Phillips Petroleum of Calgary. Westcoast has agreed to buy 65.2 MMCF daily from Phillips, which will be produced from Phillips British Columbia holdings. Phillips has also agreed to make available to Westcoast up to an additional 150 MMCF per day when required to meet increase demand by the markets served by Westcoast.

British Columbia's longest suspension "bridge," a span of 1,675 ft from tower to tower, will carry the Westcoast pipeline across the Peace River at Taylor Flats, a short distance south of Fort St. John. It will carry 2 natural-gas lines—one 26-in. which will carry gas north from Alberta fields to the $20 million gas-scrubbing plant now being built at Taylor Flats by Westcoast and Pacific Petroleums. Gas from the Alberta fields and BC will be united at the plant, and a 30-in. line will take the cleaned gas south across the bridge.

The gas-scrubbing plant, with a refinery for Pacific Petroleums and additional refinery facilities for Phillips Petroleum, will bring the total investment to $30 million—making it northern Canada's largest industry. George McMahon, president of Pacific Petroleums, said the new operation would employ several hundred persons, and would be the forerunner of other industries for the North Country.

The scrubbing plant will remove hydrogen sulfide, propane, butane, natural gasoline, and other byproducts. An agreement has been made with Jefferson Lake Sulphur Co. which will purchase hydrogen sulfide from the scrubbing plant for processing in a $2,500,000 plant now being built to produce elemental sulfur at an initial rate of 300 tons per day.

In the refinery agreement between Phillips and Pacific, Pacific will build the first section of the refinery, and Phillips the aviation-gasoline plant facilities as the second section. Operations will be integrated, with each company having an undivided 50% interest. Pacific will be the operator.

The refinery will include distillation units, a catalytic desulfurizer and reforming unit, a dehydrogenation unit, an isomerization unit, an alkylation unit; and blending, storage, and loading facilities.

Of interest to the petroleum industry in British Columbia is the provincial government's move to set up a conservation board to control the output of natural gas and oil. The new board will be in operation by the time the Westcoast line is in operation in November. Government officials are studying the methods used by the Alberta Conservation Board.

Major oil companies in the Vancouver area increased the price of their industrial fuels and heating oils by 1.3 cents per gallon in late November. Diesel fuel was also increased ½ of a cent per gallon.

MAJ. JAMES LOWERY

Major James Robert Lowery, founder of the Home Oil Co., died in Vancouver in December. He was 73.

A graduate of the University of Alberta where he won his degree in law, Major Lowery never practiced his profession. He became interested in oil exploration in southern Alberta, and in 1925 founded Home Oil Co. which later became the largest independent oil producer in Canada. Born in Welland Corners, Ontario, he moved to Alberta in 1905; and in 1912 won a seat in the Alberta legislature where he served for 8 years. He served in the First World War, and was wounded at Vimy Ridge.

Sinclair to Step Up Its 1957 Canadian Developments

Donald R. Gearhart, since 1944 vice president of Sinclair Oil & Gas Co., and a 34-year veteran Sinclair production executive, has been elected president of Sinclair Canada Oil Co., subsidiary of Sinclair, Tulsa, Okla.

With the acquisition of the Canadian properties of Southern Production Co., Sinclair now has production of about 5,500 b/d in Canada, and about 5,570,000 gross acres of undeveloped leases and reservations in British Columbia, Alberta, and Saskatchewan.

An intensified exploration and development program under a reorganized and augmented staff is planned for 1957. The program will be under the active direction of Walter P. Wilson, vice president and general manager of Sinclair Canada.

Born in Pincher Creek, Alberta, Mr. Wilson has represented Sinclair in the Mid Continent fields, in Colombia, Ethiopia, Iran and, for the past five years, in the company's Canadian exploration and production.

D. A. Jerome, since 1953 district landman for Sinclair Canada, has been named a vice president. Kenneth W. Germond, for the past eight years with Southern Production, has been appointed manager of exploration in Canada; and George F. Chadburn, former division landman for Southern, has been appointed manager of the land department.

COMMERCIAL air transportation is one of the fastest-growing industries in America. But it should never be forgotten that with almost every new stride this industry has taken, the petroleum industry has had to be one jump ahead . . . has had to be ready with the lubricants and fuels to fit the job. We of The Texas Company are proud that our association with this vital industry has been such a long and successful one. In fact . . .

For more than 20 years, more scheduled revenue airline miles in the U. S. have been flown with Texaco Aircraft Engine Oil than with all other brands combined.

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CONFIDENCE on the part of the process engineer. He knows that the BORN heater will handle the service for which it is designed.

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Avondale Marine Ways grew up with offshore drilling. It was just a decade ago that oil companies began to expand on the marshlands of lower Louisiana . . . and to venture out into the Gulf of Mexico. Special equipment was needed—and Avondale was ready to build it. Conversions in many cases were advisable—and Avondale took them on. Platforms, pipe jackets, rigs, derrick barges, tugs . . . all of the many and varied units needed—Avondale built them all. As a result, Avondale Marine Ways has an outstanding comprehensive knowledge of the specialized needs of offshore. As for service, Avondale has constantly expanded to provide the best in repair and rig up facilities. The next time you need a job done . . . call in the forces of Avondale.

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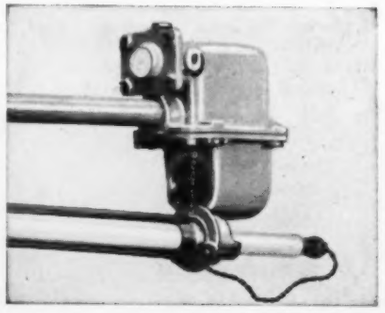

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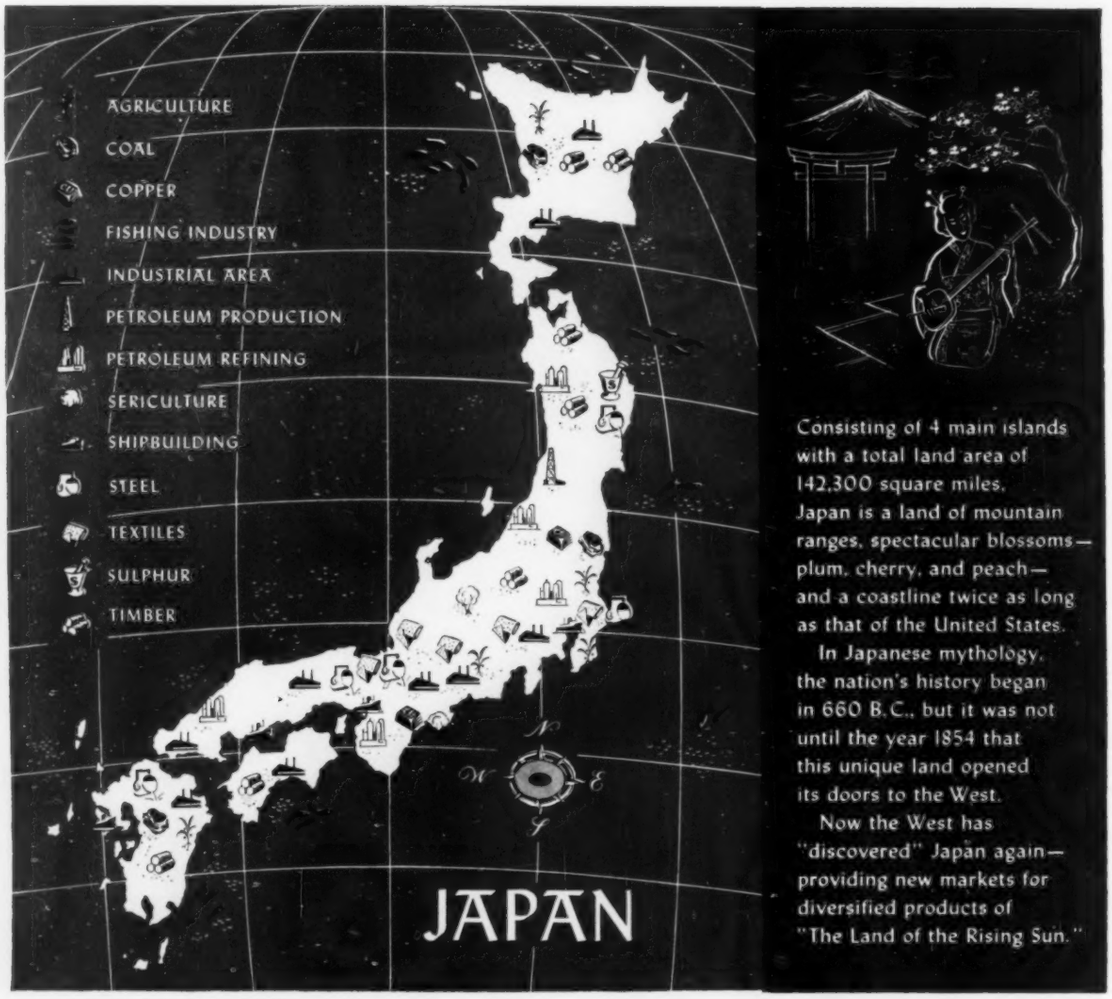


Consisting of 4 main islands with a total land area of 142,300 square miles, Japan is a land of mountain ranges, spectacular blossoms—plum, cherry, and peach—and a coastline twice as long as that of the United States.

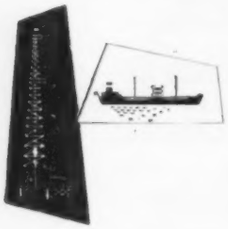
In Japanese mythology, the nation's history began in 660 B.C., but it was not until the year 1854 that this unique land opened its doors to the West.

Now the West has "discovered" Japan again—providing new markets for diversified products of "The Land of the Rising Sun."

LAND OF THE RISING SUN . . . Despite her enormous losses of manpower and productive capacity in the last war, Japan, restored to full sovereignty in April, 1952, has made a remarkable economic recovery in the short space of 10 years. Today Japan is striving successfully to meet high-level foreign demands for raw materials, textiles, machinery, precision optical goods, chemicals, and specialty food products.

Japan is America's number one customer for many raw materials and basic foodstuffs, while America in turn has become a leading market for Japanese goods. This exotic land of more than 89 million population is today the only Asian country producing and supplying machinery to countries in the East . . . petroleum demand has increased over 60 per cent since prewar days, mainly due to the enlarged scope of Japan's industrial and business activities.

Standard-Vacuum is proud of the part it has played in the economic recovery of this ancient and picturesque country through technological assistance contracts, enabling affiliated Japanese refineries and manufacturers to keep pace with the latest petroleum refining techniques and to utilize a number of processes developed abroad during the past decade.



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DU PONT *Petroleum Chemicals* NEWS

One of a Series of Bulletins for the Petroleum Industry

FEBRUARY 1957

Critical lubricating problems indicate growing market for estersil greases

There is a steadily growing number of industrial processes where lubricants are exposed to water and intense heat, combined with vigorous working. These applications demand lubricant performance beyond the capability of ordinary greases.

By using Du Pont Estersil GT (grease thickener), several industrial lubricant makers are meeting this demand for better greases with considerable success. Here is a typical example of how estersil can help grease suppliers meet unusually difficult lubrication requirements.

Grease life extended

A pigments manufacturer had been using a conventional grease for lubricating chemical dryer racks. This grease lost its lubricating qualities after one trip through the drying oven where the temperature averaged 120°C. This made the racks (weighing 2500 lbs.) difficult to roll manually, and resulted in excessive downtime for frequent greasing.

To increase the efficiency of this process, an estersil-based grease was tried. Success was immediate. The racks rolled easier and downtime for greasing was cut in half.

Safety increased, too

In addition to the economy realized through reduced downtime, this company got an extra dividend in increased safety. With the conventional grease, an accident occurred in which the operator's hand and wrist were jammed because the rack would not roll easily. And the danger of this—plus physical strain—occurring frequently was great. But, by making the racks roll more easily, the estersil grease eliminated this hazard.

Broad market

There are many other similar applications where greases made with Du Pont Estersil GT can best meet the critical demands of high-temperature operation, or where high water resistance is needed. They have, for example, increased efficiency in enamelling-oven conveyor setups having operating temperatures as high as 500°F.

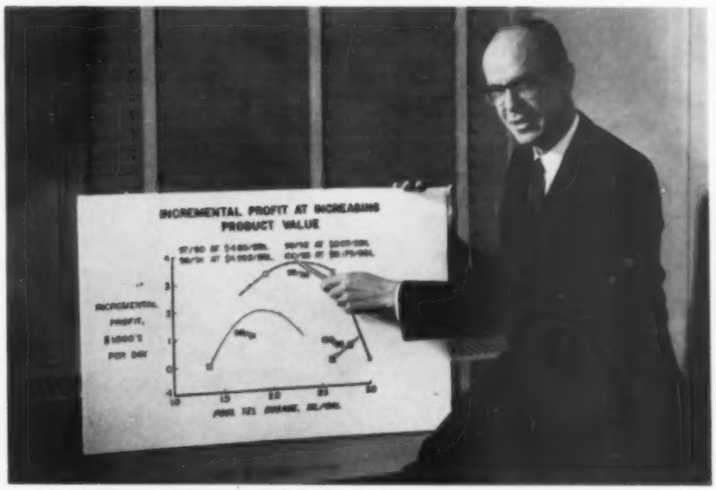
Farm tractors, mining machinery, and heavy construction equipment represent another big market for estersil-based greases. In these applications they give better protection against dirt, water and rough going . . . and help to cut maintenance costs by increasing lubrication efficiency and by reducing downtime for greasing.

Any of our sales offices will be glad to furnish more information on Du Pont Estersil GT and how it can increase grease sales and profits potential.

How economic study of operations helps increase refinery profits

by Jack S. Bellah

A modern refinery of course offers many process and gasoline blending possibilities. And selecting the combination of the variables that will produce desired product quality most economically requires a careful analysis of plant operating and laboratory blending data. Refiners who do not have their own staffs to do this work are invited to consult with Du Pont.



MANY YEARS' EXPERIENCE in refinery technology enables Mr. Bellah to make a practical, accurate economic-analysis of many refinery operations.

Those having their own economic study group may want to compare their results with ours to see if perhaps a different viewpoint can lead to further economies.

A Du Pont service

As a supplier of tetraethyl lead, we at the Du Pont Company are continuously analyzing typical refinery operations to determine their effect on the additives business. In discussing our general conclusions with people in the industry, we have been asked in several instances to make such an analysis for a specific operation. We are always glad to provide this help as a service to the refiner.

To illustrate how this service has

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OVER

DUPONT *Petroleum Chemicals* NEWS

CONTINUED *Refinery Profits*

been used, here are the results of one such investigation:

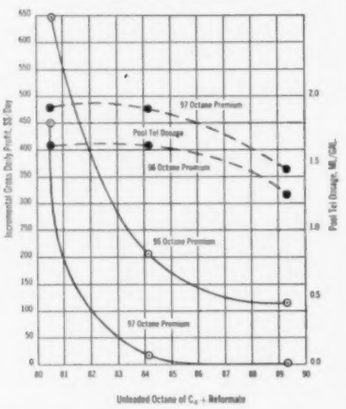
A case history

A small modern refinery recently added a catalytic reformer to the processing facilities. Three reformer operating conditions were compared—low level, design, and high level severity. A fourth case, involving jet fuel production and non-operation of the reformer, permitted calculating the break-even gross value of those gasoline components which went into the jet fuel production. Two premium gasoline octane levels also were to be considered.

The results are shown in the graph at left and in the table below.

FIGURE 1

Economic Study of Catalytic Reforming Operations



Profit up $400 per day

At the platformer design operating condition – 90% C_4 plus recovery of 84.2 clear octane product – the daily gross profit was calculated to be some $400 less than that obtained from an operation yielding 91% C_4 plus recovery of 81.1 clear octane product. This, as you can see in the table at left, was indicated at both 96 and 97 octane premium levels.

On the other hand, a disadvantage was indicated for operation at any higher severity level than the design condition. This led to the general conclusion that an even lower level of operating severity than the one estimated might be still more attractive.

Available to you

By comparing notes with you on the most economical processing steps and reforming severity, in relation to your own individual stocks and market requirements, there is a chance that we can provide a service to your own process engineering group. Just drop us a line if you would like us to discuss this service with you.

TABLE 1
Economic Study of Catalytic Reforming Operations

	Design	Lo Level	Hi Level	Down
Reformer Operation				
C_4 + Clear Research Number	84.2	81.1	89.3	Jet Fuel
Pool TEL Dosage Ml/Gal.				
96 Premium	1.625	1.65	1.275	2.685
97 Premium	1.895	1.92	1.44	2.97
Product Realization, $/CD	38880	39205	38625	30885
Variable Costs, $/CD				
96 Premium	2965	2850	2805	2965
97 Premium	3160	3045	2920	3125
Net Gross Realization, $/CD				
96 Premium	35915	36355	35820	27920
97 Premium	35720	36160	35705	27760
Incremental Gross Profit, $/CD				
96 Premium	210	650	115	
97 Premium	15	455	0	
Jet Fuel Break-Even with Best Performance Case, $/CD				
96 Premium – 11.2¢/Gal.				8435
97 Premium – 11.1¢/Gal.				8400

Residual fuel sludge problems solved with Du Pont FOA-2

At a midwestern manufacturing plant, the oil pump of an underground heavy-oil storage tank became ineffectual because of a sludge accumulation blocking the supply line. Five gallons of Fuel Oil Additive No. 2 were added to the tank, and the fuel was recirculated for several days. In this way, enough sediment was removed from the tank to permit operation of the pump.

Not only had FOA-2 dispersed the sludge—but the filters *remained* clean afterward. And the oil containing the sludge was burned in a normal manner without any harmful effect on the combustion system. Also, this simple and inexpensive method eliminated the hazardous and expensive job of lowering a man into the tank to remove the sludge mechanically.

Another FOA-2 Economy

At a New Jersey chemical plant, periodic cleaning of a heavy fuel-oil storage tank was required. In addition, large particles of solid material on the strainer before the pump caused an increase in the pump suction vacuum. On several occasions, pump suction was lost completely.

Outside service companies had previously been employed for a similar cleaning job. This time, however, it was decided to try another method. One hundred pounds of FOA-2 per 1,000 barrels were put in and the oil was recirculated.

Examination of the strainers showed no sludge-binding material. As a result, pump suction vacuum dropped to normal where it stayed. To maintain these improvements, FOA-2 is now being used regularly in a concentration of 35 pounds/1,000 barrels.

These case histories show how existing sludge problems can be easily solved and—better—prevented, through the addition of FOA-2 at the refinery.

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OVER

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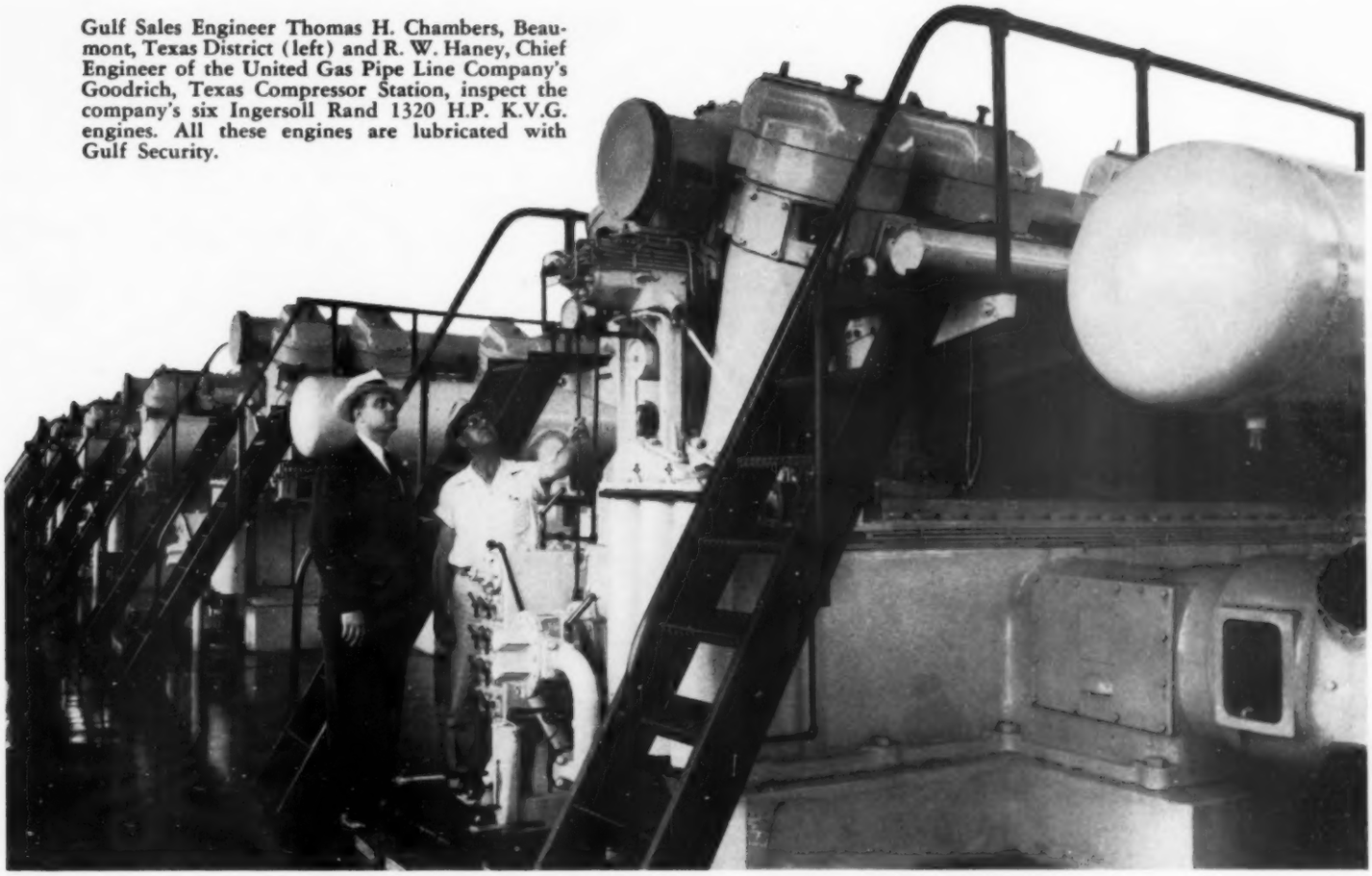

Gulf Sales Engineer Thomas H. Chambers, Beaumont, Texas District (left) and R. W. Haney, Chief Engineer of the United Gas Pipe Line Company's Goodrich, Texas Compressor Station, inspect the company's six Ingersoll Rand 1320 H.P. K.V.G. engines. All these engines are lubricated with Gulf Security.

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Make certain your units receive safe, effective lubrication protection—specify Gulf Security. And remember that Gulf provides the services of a trained, experienced petroleum expert—the Gulf Sales Engineer—to help you with any problem involving a petroleum product. Consult the telephone directory for the number of your nearest Gulf office.

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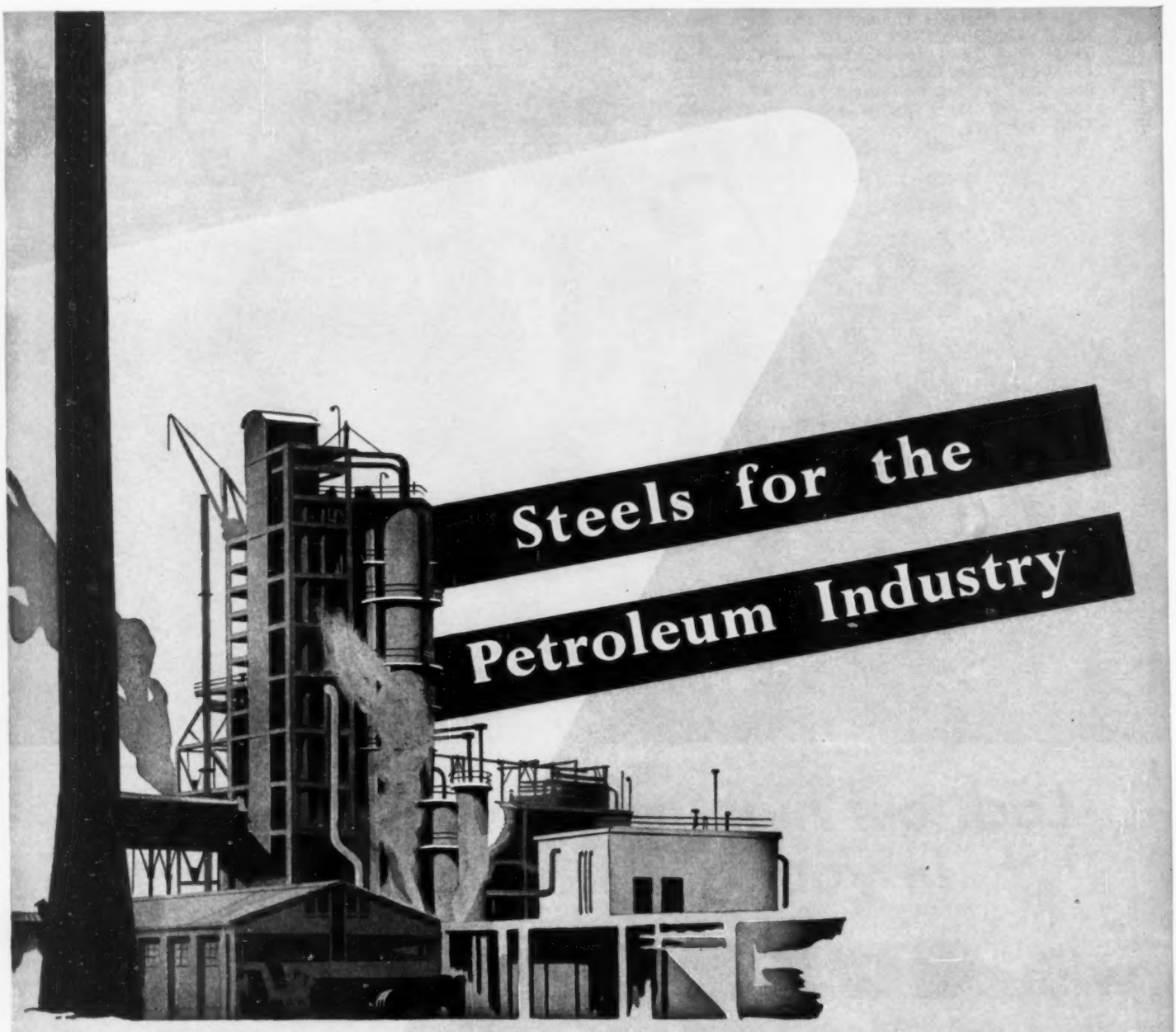

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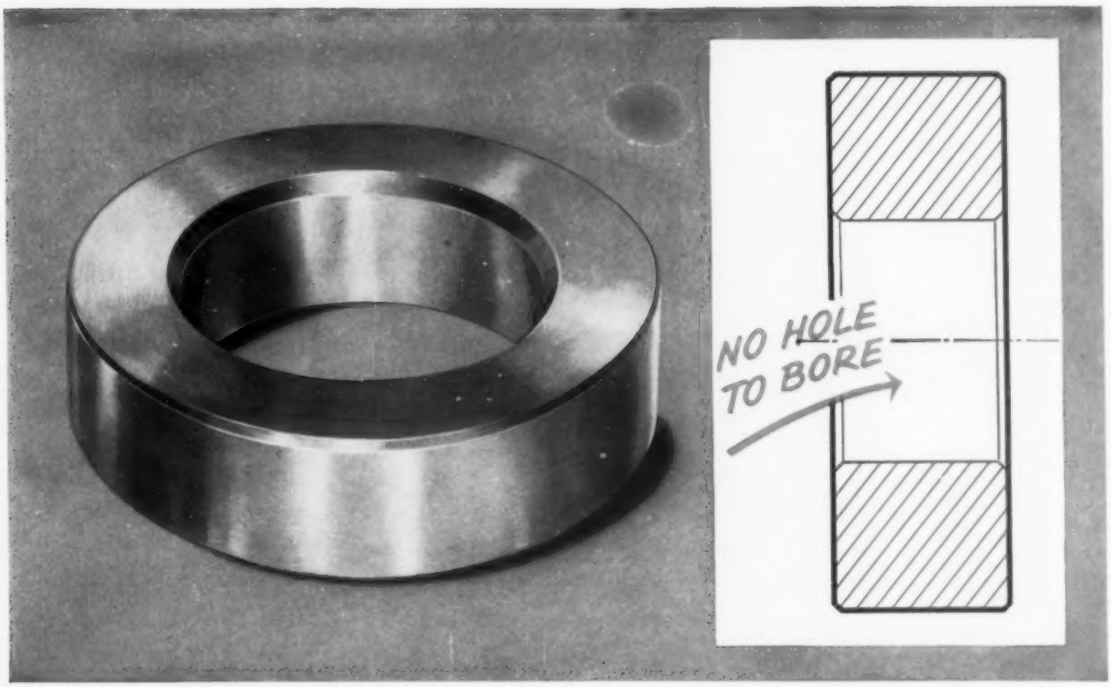

Steps up gear blank production 300% by switching from bar stock to TIMKEN® steel tubing

AN engine manufacturer felt that his gear blanks were costing him too much to make. The center hole had to be bored out of solid bar stock. It took a whole hour to turn out 29 blanks. And a lot of steel was wasted in the process.

So the manufacturer discussed his problem with metallurgists of the Timken Company, experts in fine alloy steel. After study they recommended a change in production methods together with a switch to Timken® seamless steel tubing in place of bar stock.

With Timken seamless steel tubing, the center hole is already there. It doesn't have to be bored out. Finish boring was the engine maker's first production step. And with Timken steel tubing his gear blanks are now being turned out at 120 to 130 an hour—an increase of 300%.

Machining costs have been cut by more than half. And because the center hole is "built-in", no steel is wasted.

The files of the Timken Company contain records of hundreds of problems that have been solved by Timken fine alloy steel. If you have a tough steel problem, why not bring it to us? Wire, write or phone The Timken Roller Bearing Company, Steel and Tube Division, Canton 6, Ohio. Cable address: "TIMROSCO".

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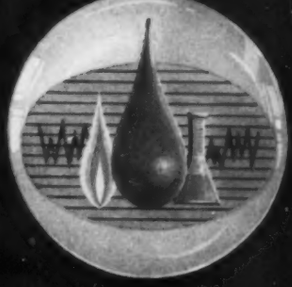
PACIFIC PUMPS, INC., Huntington Park, Calif.—Centrifugal pumps for refineries, power stations, pipelines, and chemical plants; plunger pumps for oilwells.



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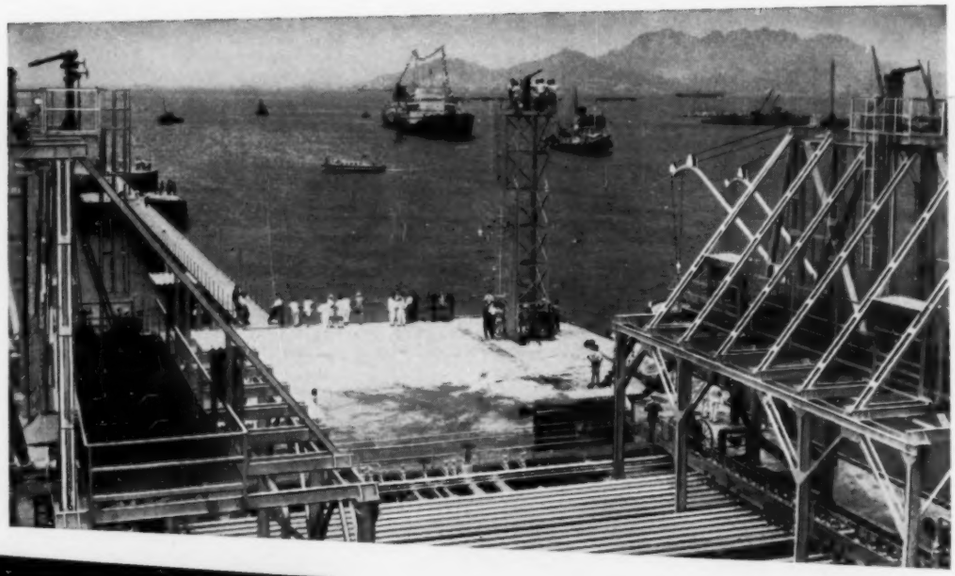

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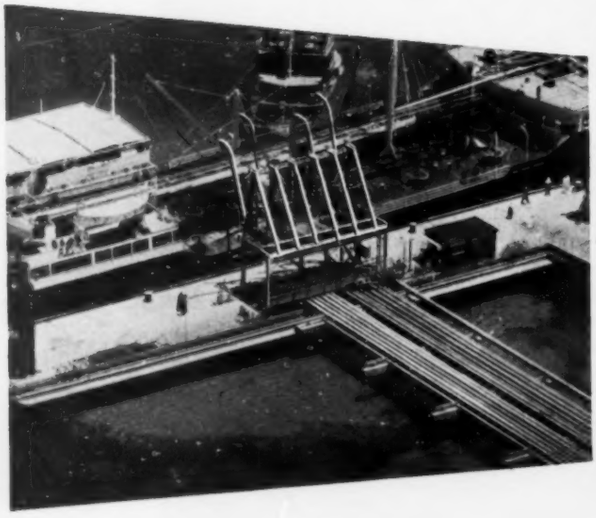

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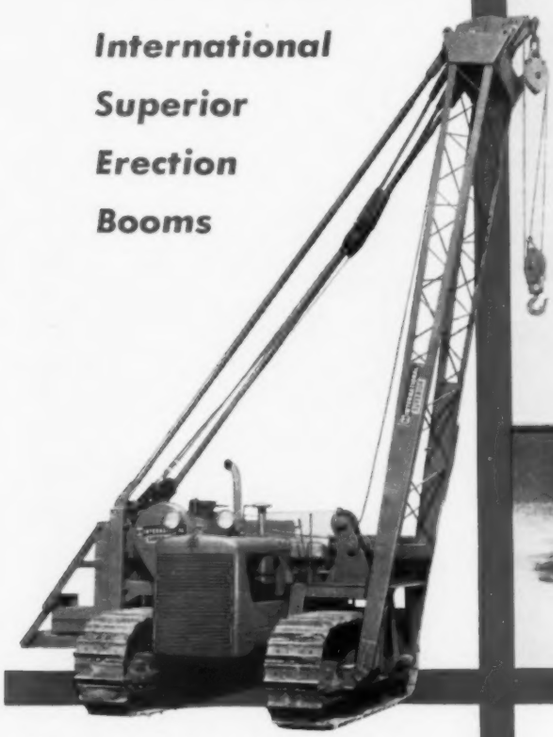
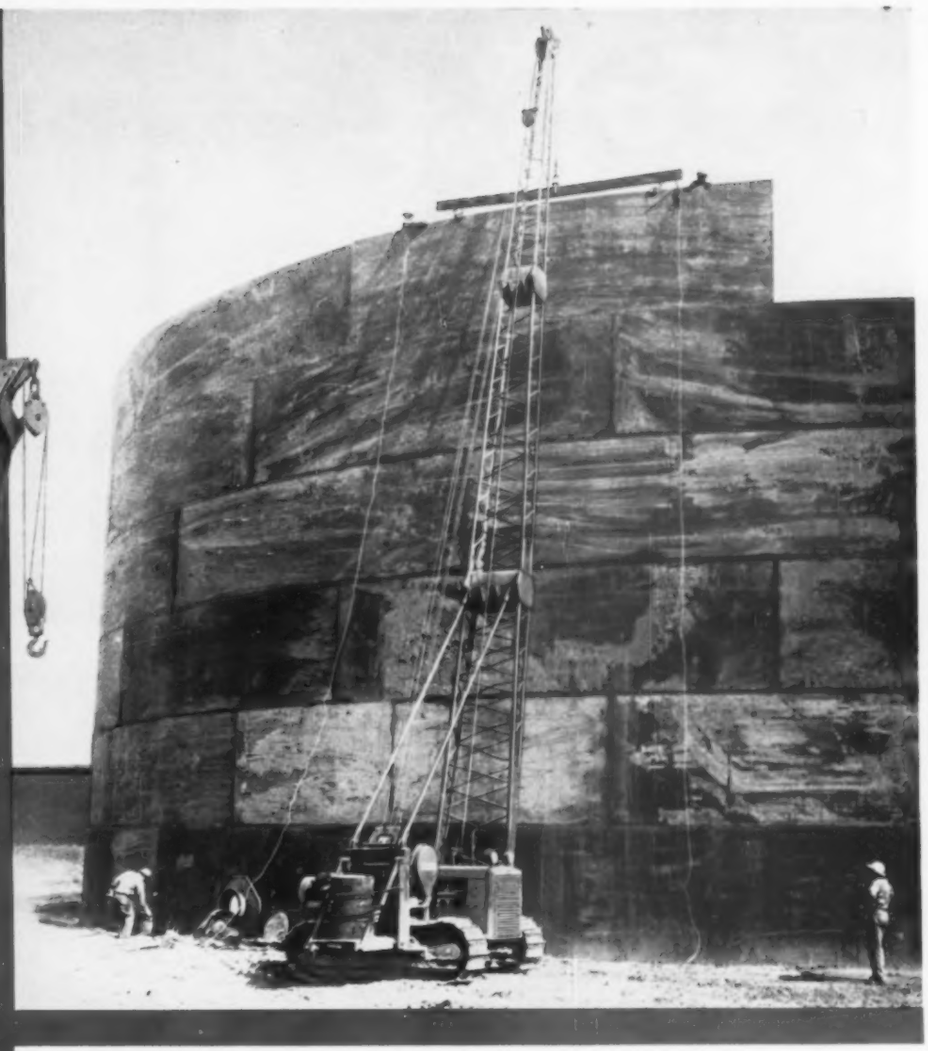
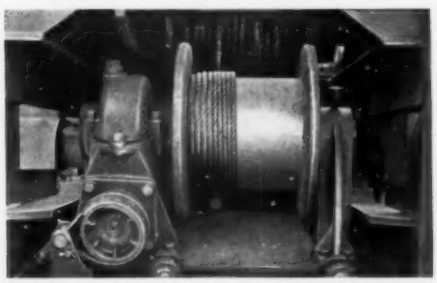




A hinged counterweight platform makes it unnecessary to carry excess weight either at the site or in transporting. Your on-the-job counterweight costs nothing—just add any weight handy, as necessary to make your lift.

All controls are conveniently placed for faster working and greater safety. Operator has excellent visibility. Note load cable safety shield.



Worm driven boom drum gives precision control up or down. The automatic boom drum brake gives maximum safety by holding the boom exactly where you want it.

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The International Superior EB-142 Erection Boom was designed and built in conjunction with one of the largest steel erection construction companies in the world. As a result, it has all the latest, most-wanted on-the-job features... safety and convenience of operation, advanced engineering control mechanism and all-around versatility of 1, 2 or 3 section booms.

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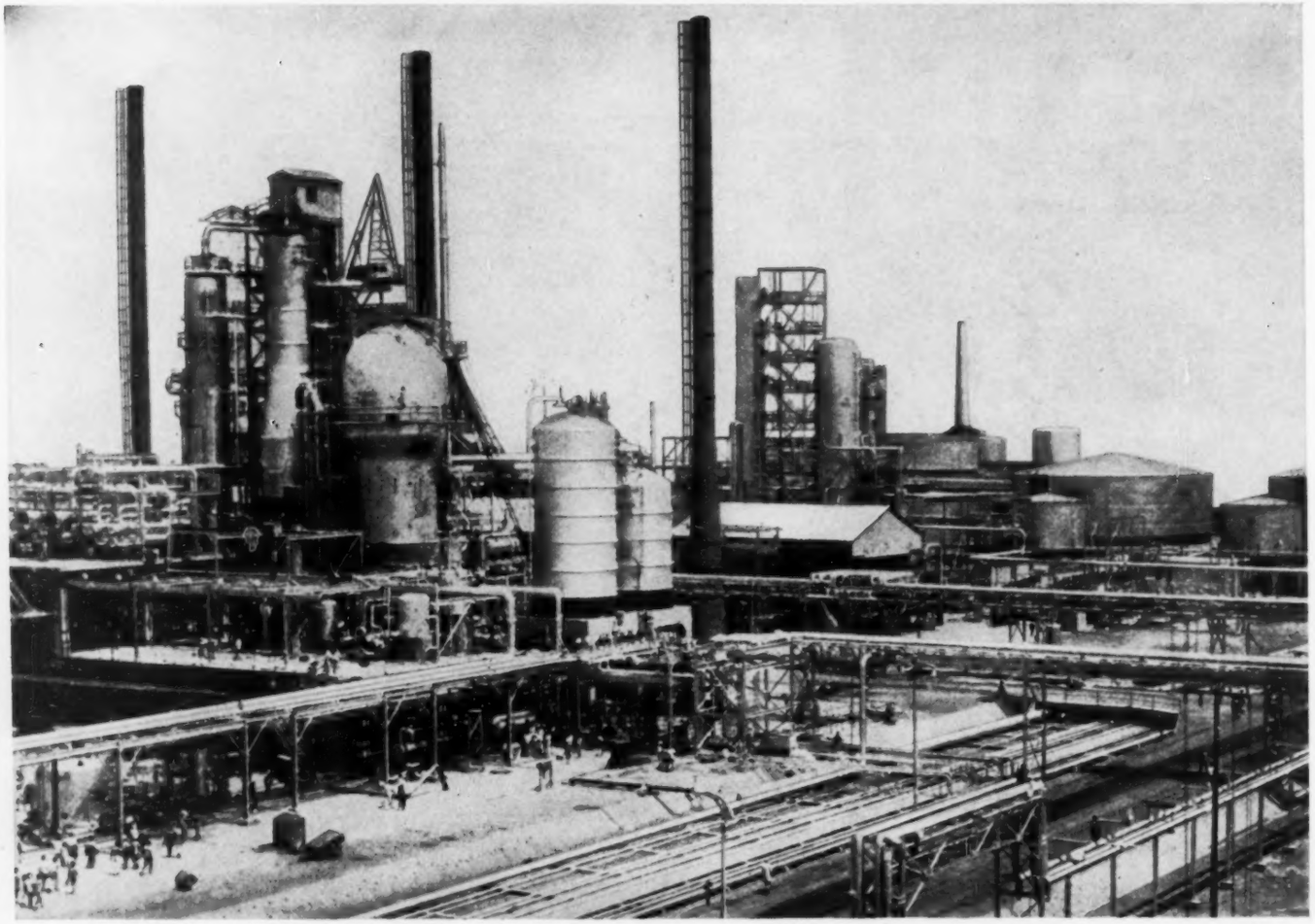

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Editor Emeritus E. W. MAYO
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Managing Editor G. H. BARROWS
Associate Editor ELOISE MICHEL
Production Manager A. V. HARCOURT
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Member of National Business Publications, Inc., and Business Publications Audit of Circulation, Inc.

SUBSCRIPTIONS

1 year, $10.00 2 years, $18.00
3 years, $25.00 Single copies $1.00

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WASHINGTON, D.C.

J. B. Huttlinger National Press Building
14th and F Streets (Tel. EX3-3733)

LOS ANGELES 14

T. T. Drake 412 West Sixth St. (Tel. MUtual 1391)

NEW YORK 20

Sales Representative
E. L. Townsend
604 Fifth Avenue (Tel. JUdson 6-4820)

TULSA 3

O. F. Cozier, Mid-Continent Advertising Manager, 305 Daniel Bldg. (Tel. Diamond 3-1335)

World Petroleum is published by
Mona Palmer, Trustee
under the will of Russell Palmer

VOL. 28, NO. 2 FEBRUARY, 1957

World Petroleum

THE MANAGEMENT PUBLICATION OF THE INTERNATIONAL PETROLEUM INDUSTRY

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THIS MONTH'S COVER

International Nickel Co. recently presented a painting to Universal Oil Products Co. depicting the catalytic action of platinum on petroleum naphthas in the Platforming process. The painting was done by Avery F. Johnson, a member of the faculty of two art schools in New Jersey. Reproduction on the cover is through the courtesy of International Nickel Co.

... what makes a hole a well?

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"PROGRESS IN SERVICE THROUGH RESEARCH"

Free Enterprise Pays In Venezuela

IN its younger and more boisterous days the petroleum industry was generally referred to as the "oil game." Later the term was frowned upon in some quarters as not fitting for an enterprise of such stature and stability. Some thought, for example, that the bankers would be more likely to lend money to an industry than to a "game."

The term may be inelegant, but it does describe one of the most important elements in the industry—competition. All games are competitive, and that is their attraction for both participants and spectators. Without the competitive spirit games would indeed be dull for the players, and certainly would offer no opportunity for profit at the box office.

With rare exceptions, monopolistic industry is dull. The natural incentive present in competitive free enterprise is missing. There is lack of development and growth. Areas in which free enterprise is missing tend to have a lower standard of living.

The Western Hemisphere presents outstanding examples of both philosophies. Argentina is an example of a nation which does not now welcome free enterprise in the development of its resources. Possessed of what most geologists believe are vast potential petroleum reserves, Argentina prefers to import millions of barrels of oil each year from the Middle East and from her sister republic, Venezuela, rather than to permit foreigners to vie for the privilege of spending their own capital in bidding for concessions and searching for domestic supplies.

Venezuela also has great natural resources, but has taken a contrary attitude. To Venezuela, free enterprise must look very good, indeed, at this particular moment. The government and the people have profited through competition in the "oil game." The national treasury is richer by nearly half a billion dollars as a result of the recent competitive bidding of oil enterprises seeking the right to explore new concessions.

The Hydrocarbon Ministry of Venezuela is made up of keen minded men who are dedicated to the welfare of their country. For years they have worked harmoniously with the oil industry. They have recognized that the industry must have an opportunity to make a good profit; otherwise oil men will not risk their money or that of their stockholders. At the same time they have made sure that the people of Venezuela profited from their resources. In a few years the nation has become the world's second largest oil producer.

The recent bidding for new concessions is an example of how Venezuela profits from free enterprise. Word was passed around a year or two in advance that the government planned to open new territory to exploration and development. It was said that new companies would be welcome to bid.

Result was that a considerable number of new companies sent experts to make studies. Bidding for the new tracts was keen. The highest bidder got the concession in every instance. Venezuelan's treasury is bulging with new cash.

More important, from the standpoint of Venezuela, is the fact that the new properties will be tested at no cost to the people. If they become producers, the people will share in the profits. If they are dry, that will have cost the people nothing. The "game" has been good box office for Venezuela.

Win or lose, the oil men also will have no regrets. That is part of the free-enterprise system, the competitive "game" which has built a great international industry and added to the comfort and well being of mankind.

END

Commemorating the spectacular 7-year history of the development of platinum catalyst reforming, International Nickel presents symbolic painting to Universal Oil Products Co.

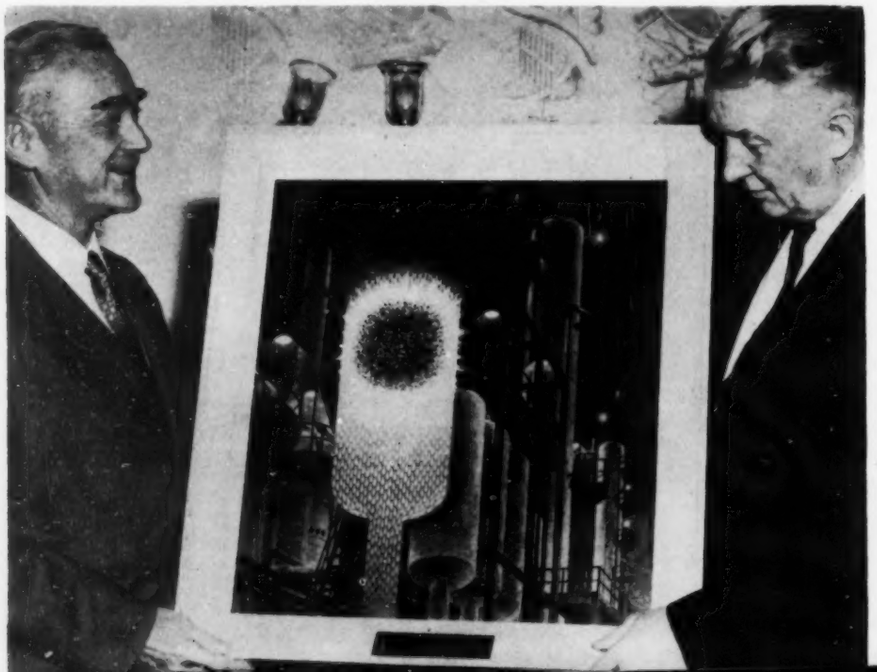
PLATINUM PRODUCER HONORS UOP FOR REFORMING DEVELOPMENT

ON December 11, 1956 representatives of International Nickel Co. were hosts at a dinner in Chicago to a small group of executives of Universal Oil Products Co. The occasion was to pay tribute to Universal's work in developing the first successful platinum catalyst for naphtha reforming. A striking painting was presented to UOP at the dinner in honor of Universal's development of the Platforming process. It symbolizes what occurs when naphthas are reformed over platinum catalyst. A full-color reproduction of the painting is shown on the front cover of this month's issue.

The inscription on the picture reads: "Presented to Universal Oil Products Company by The International Nickel Company, Inc., in appreciation for their outstanding work in the development and application of platinum catalysts for the petroleum industry, December 11, 1956."

International Nickel is one of the world's largest suppliers of platinum, in addition to its preëminent position as a supplier of nickel and a host of alloys containing nickel, chromium, and other metals for special-purpose applications in the field of corrosion prevention. Thus it is in an authoritative position to evaluate the effect of Universal's development on the usage of platinum by the oil industry, which had its public beginning March 30, 1949, when, in a paper discussing refinery developments in general, UOP announced the commercial availability of the first platinum reforming process, viz, Platforming.

Colonel J. C. Raaen (left), Universal vice president and manager of its research and development laboratories, accepting painting from B. B. Morton, in charge of petroleum developments for International Nickel Co.



In the succeeding 7 years, reforming over a platinum catalyst has jumped from nil to nearly 1.5 million barrels per day in the United States and Canada alone. On a worldwide basis, the increase has been even more spectacular. It has brought catalytic reforming from the status of an almost discarded wartime refinery process to one of the most important tools available in the production of high-octane gasoline and aromatic hydrocarbons from petroleum naphthas.

UOP had long been searching for a better catalytic agent to use in catalytic reforming, considering the process as offering the most feasible means of upgrading low-octane straight-run naphthas. Existing reforming methods—some of them thermal, others employing catalysts—had been giving low yields, since certain reactions could not be controlled sufficiently to prevent the

formation of excessive amounts of gases for which there was no remunerative market.

UOP's research teams had already been up many blind alleys when the idea evolved of experimenting with catalysts containing noble metals. It was hoped that one or more of them might be the key to greater yields, and perhaps even higher octane ratings would be obtained than the existing state of the art then permitted. Until this time, however, no one had seriously thought of using what were predominantly considered as jewelry metals in the substantial quantities which would be required in commercial refining catalysts.

Preliminary investigations showed that platinum had great promise in eliminating the undesirable side reactions which had plagued all previous approaches. One big hitch was the price of platinum, which had ranged from as little as $35 to as much as $120 per troy ounce—even a small processing unit by usual refinery standards would require several pounds of the metal.

Then there were the potential consequences of failure. All the work called for would involve a serious drain upon the company's financial and technical resources. Worst of all was the question of whether the refining industry seriously would consider using a high-cost scarce material such as platinum in a catalyst to produce a low-priced high-volume product such as gasoline, even if a workable process were demonstrated in the pilot plant.

After careful consideration of all the aspects of the problem, however, UOP's officials authorized the additional research necessary to develop a workable process of sufficient economic feasibility to warrant a commercial trial. For instance, the best catalyst composition had to be determined for the various naphthas which likely would be encountered in actual refinery applications. Next, the best methods had to be selected to manufacture this catalyst on a large scale. The usual catalyst manufacturing techniques had to undergo a complete metamorphosis. Losses of precious platinum during manufacture had to be eliminated if the new catalyst was not to be fantastically expensive. Furthermore, methods had to be developed to recover platinum from spent catalyst for re-use.

The usual development research had to be done to determine proper reaction conditions. The size of equipment, arrangement of reactor internals, and the thousand and one other things which go into the creation of an entirely new process had to be worked out by scores of engineers and chemists. This meant long hours of expensive pilot-plant experimentation and even more hours of delicate analytical work.

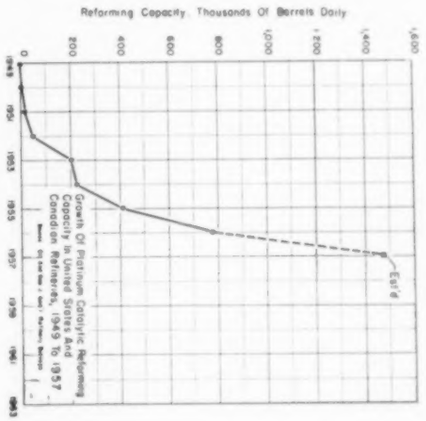
Thus was born the Platforming process. Not only did it give refiners a new tool for improving motor and aviation gasoline, it put the oil industry into the business of manufacturing large quantities of aromatic hydrocarbons for the chemical industry. These now are being transformed into petro-chemicals which appear in such diverse forms as synthetic fibers, plastics, synthetic rubbers and explosives. The world now is no longer dependent upon coal as its sole source of the light aromatics—benzene, toluene, and the xylene isomers. The process relieved critical shortages of aromatic chemicals in the Korean conflict.

Platforming is responsible for the pyramiding of the oil industry from a practically insignificant employer of platinum into one of the world's largest users of this valuable metal. It is estimated[1] that catalysts employed in units of various catalytic reforming processes—now operating in the Free World, under construction, or in process of design—will utilize in excess of 87,000 avoirdupois *pounds* of platinum by the end of 1957. If calculated at the rate of $106 per troy ounce—about the present US price—this represents a value in excess of $135 million. So important is platinum in refining today that the US government is stockpiling unstated large quantities because of its strategic value.

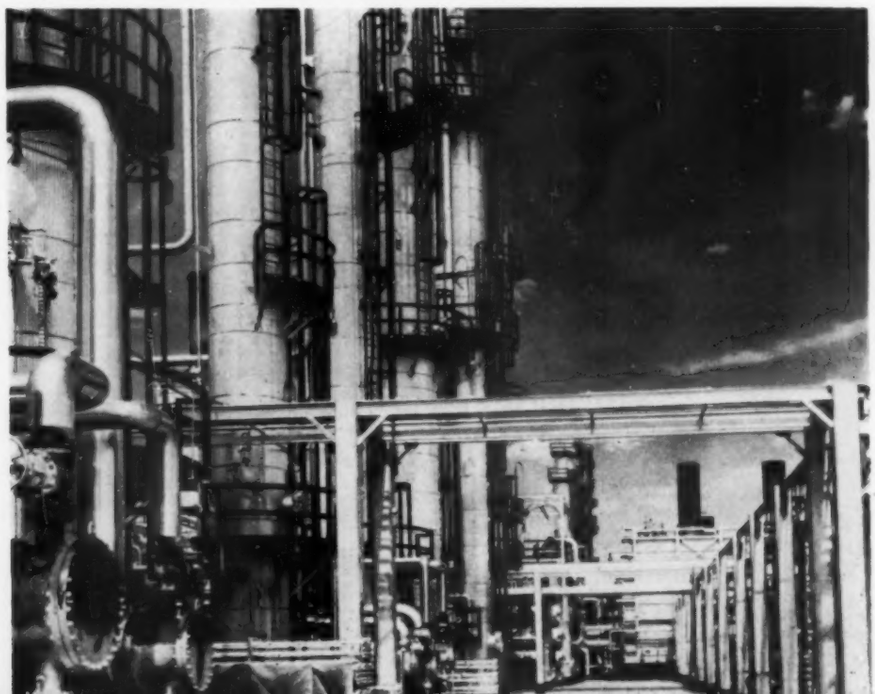
Platforming and the other platinum-catalyst processes which followed it became the most quickly adopted of all peacetime refinery processes. Small, independent refiners showed their pioneering spirit by their willingness to employ so revolutionary a catalyst, and were able to maintain their competitive position in the high-octane motor-fuel market by doing so.

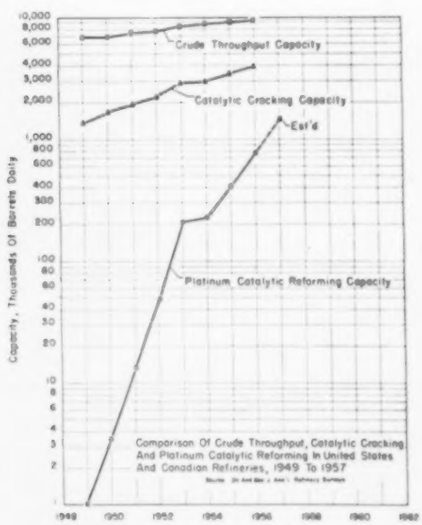
A refinery executive who heard the UOP paper at the Western Petroleum Refiners Association meeting in San Antonio in 1949 was in UOP's Chicago offices before that week had been out, asking for particulars on how this new process could be fitted into his refinery. Two hundred ten days following the announcement at San Antonio the first Platforming unit—with a capacity of 1,500 bbl per stream-day—went onstream in what was then the Old Dutch Refining Co.'s plant at Muskegon, Mich. (now Aurora Gasoline Co.). The capacity of this unit has since been nearly doubled, and it still is in operation.

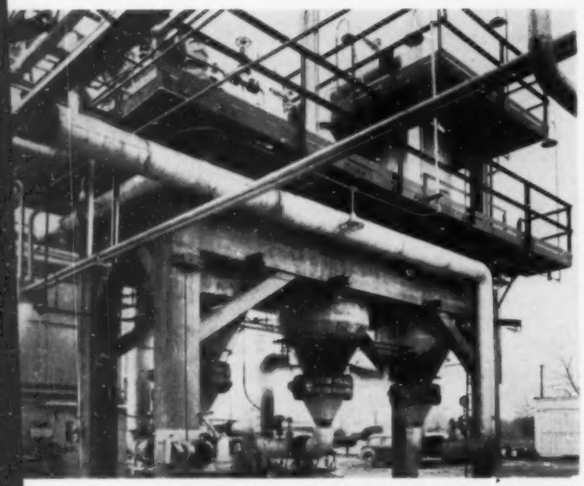
Platforming caught on so quickly among the small refiners—not alone because they were "scratching" then to keep up with the octane race, for which catalytic cracking was not the technical and economic answer to their problem—but also because they


Reforming Capacity, Thousands Of Barrels Daily
Growth Of Platinum Catalytic Reforming Capacity In United States And Canada, 1949 To 1957
8,153

Part of the distillation and solvent-extraction sections of the UOP Rexformer at Cosden Petroleum Corp.'s Bring Spring, Texas, refinery—the latest installation of its type for octane improvement.




Crude Throughput Capacity
Catalytic Cracking Capacity
Est'd
Platinum Catalytic Reforming Capacity
Capacity, Thousands Of Barrels Daily
Comparison Of Crude Throughput, Catalytic Cracking And Platinum Catalytic Reforming In United States And Canadian Refineries, 1949 To 1957

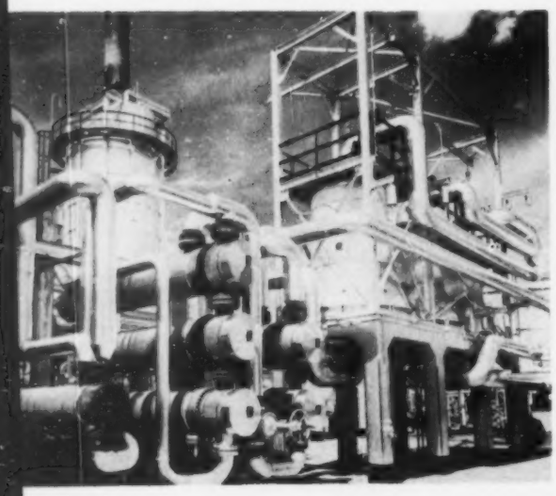


Reactor section (with heaters in the background) of the first commercial UOP Platforming unit, which went onstream, October 27, 1949, in the Muskegon, Mich., refinery of Old Dutch Refining Co. (now Aurora Gasoline Co.). This unit is still operating.

were already familiar with the company which had developed it. In the first two years following its announcement in 1949, eight more Platformers were installed—none of which exceeded 4,000 b/sd in capacity, and only one of which was in a large refinery of a major oil company. It was not until the past three or four years, when even the large refineries likewise became pinched for octane numbers despite their extensive catalytic cracking installations, that large platinum reforming units have been constructed in the major refineries of the world. Several of these plants already have come back for "seconds," and one refinery soon will have three.

Like many another outstanding achievement, the success of Platforming was followed by parallel activities in other research organizations. As a consequence, there are six other reforming processes employing platinum catalysts, in addition to Platforming, now available to the industry. Platforming remains unique because, of them all, it is nonregenerative.

Reactor section of UOP Rexforming unit—the latest development in reforming with a platinum-containing catalyst: This unit (in the Big Spring, Texas, refinery of Cosden Petroleum Corp.) has made a Rexformate testing over 104 "research" octane (with TEL addition).



According to published reports, The Atlantic Refining Co.'s "Catforming"[2,3,4] was the first platinum-catalyst competitor of Platforming. The first unit went onstream in August 1952. The first unit employing Houdry Process Corp.'s "Houdriforming"[2,5,6] initially was operated either in November or December 1953. Other platinum-catalyst reforming processes, their developers, and onstream date for the first unit employing the process include:

"Sinclair Baker RD-150 catalyst,"[2,7,8] Sinclair Refining Co. and Baker and Co.; September 1954.

"Ultraforming,"[2,9,10] Standard Oil Co. (Indiana); May 1954.

"Sovaforming,"[2,11,12] Socony-Vacuum Oil Co. (now Socony-Mobil Oil Co. Inc.), using the Sinclair-Baker catalyst; November 1954.

"Powerforming,"[13,14] Esso Research and Engineering Co. process named in March 1956; first unit operated in May 1955."

UOP announced a variation upon Platforming which it called "Rexforming," in March 1955[2,15,16]. It introduced solvent extraction of the high-octane components, and permitted recycling of the low-octane hydrocarbons to extinction, if desired. At the same time, Houdry Process Corp. also announced a variation upon its "Houdriforming," which it calls "Iso-Plus"[2,17,18,19]. One modification of this also employs solvent extraction. The first commercial units employing these processes were placed in commercial operation during 1956.

The growth of catalytic reforming has not been so rapid outside North America, primarily because it has been only in the past two or three years that these other areas have had a need for higher octanes and the necessity for the upgrading of straight-run naphthas which catalytic cracking could not provide. However, there is hardly any major refining area in the Free World today where catalytic reforming with platinum is not employed.

Platinum-catalyst reforming at first was in competition with thermal reforming and with catalytic reforming processes employing catalysts which do not contain noble metals. Initially, this competition came largely from units built during World War II, notably "Fixed-Bed Hydroforming"[2] which had been developed by Standard Oil Development Co. (now Esso Research and Engineering Co.) in conjunction with Standard Oil Co. (Indiana) and The M. W. Kellogg Co., and "Cycloversion," developed by Phillips Petroleum Co.

Two years after Platforming had been announced, "Thermofor Catalytic Reforming" and "Fluid Hydroforming"[2] were announced, respectively, by the then Socony-Vacuum Oil Co. and Standard Oil Development. Both use nonplatinum catalysts. "Hyperforming," developed by Union Oil Co. of California, and "Orthoforming," by The M. W. Kellogg Co., are the latest to be announced of the nonplatinum catalyst reforming processes.[2] Commercial units employing all of these nonplatinum catalyst reforming processes are in operation.

The startling growth of reforming using a platinum-containing catalyst is evident in Fig. 1. This shows reforming capacity in the USA and Canada, from 1949 to the present, as reported in the annual refinery surveys conducted by *The Oil & Gas Journal*,[20] published each March and dated as of January 1 for the year shown. If Free World capacity figures had been used instead of those for only the USA and Canada—taken because this area has the longest experience history in platinum-containing catalytic reforming—the capacity increases shown in Fig. 1 would be even greater.

A comparison of the growth of platinum catalyst reforming with the increases in crude throughput capacity and in catalytic cracking capacity is shown in Fig. 2. Crude capacity in the USA and Canada totaled 8.8 million barrels per day in 1949, and was 9.6 million barrels as of January 1, 1956. Individual annual capacity increases have ranged from a low of 0.5% to a high of 10.7%, with an average annual capacity increase of 5.1%.

Increases in catalytic cracking have ranged from a low of 3.4% in a single year to 30.8%, the average being 16.7% per year from 1949 to 1956. Platinum catalytic reforming started off by nearly tripling for each of the first two years following its introduction, more than tripling in each of the next two years, and—including the estimated capacity as of January 1, 1957—has averaged an increase of 180.3% annually from 1949 to 1957.

The boom which was so evident in the USA by 1953 spread over the Free World in the following years. Latest published reports, which probably are conservative, indicate that, worldwide, there now are about 1,100,000 b/sd of capacity in platinum catalyst reforming units in operation. These sources[20,21] also indicate that at least 775,000 b/sd were planned or under construction after January 1, 1956. Further substantial increases are in prospect. END

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1955 WORLD OIL PRODUCTS DEMAND

ESTIMATED DOMESTIC DEMAND FOR MAJOR PRODUCTS, YEAR 1955
(Thousands of Barrels—Source: U. S. Bureau of Mines)

Country	Motor Fuel	Kerosine	Distillate Fuel Oil	Residual Fuel Oil	Lubricating Oil	Total Major Products 1955	Total Major Products 1954
NORTH AMERICA & CARIBBEAN							
Alaska & Hawaii	5,000	150	2,700	5,900	120	13,870	13,810
Canada	80,554	14,038	56,050	46,500	3,000	200,142	180,887
Central America	3,320	630	3,820	5,920	90	13,780	11,588
Cuba	5,701	861	2,274	10,164	220	19,220	18,074
Dominica	680	90	300	740	50	1,860	n.a.
Haiti	310	30	210	100	4	654	n.a.
Jamaica	541	136	539	1,910	19	3,145	n.a.
Mexico	23,500	7,600	8,700	25,000	850	65,650	62,720
Puerto Rico	3,600	740	820	3,850	60	9,070	7,105
Trinidad	714	201	1,990	7,200	40	10,145	n.a.
United States	1,321,730	116,815	581,351	557,423	42,480	2,619,799	2,443,518
Other West Indies	—	—	—	—	—	—	50,347
TOTAL ABOVE	**1,445,650**	**141,291**	**658,754**	**664,707**	**46,933**	**2,957,335**	**2,788,049**
SOUTH AMERICA							
Argentina	14,500	7,380	11,000	35,900	1,150	69,930	64,350
Bolivia	637	148	215	634	10	1,644	1,473
Brazil	23,932	4,559	10,352	24,538	1,360	64,741	58,043
Chile	3,390	1,320	1,710	6,300	170	12,890	10,992
Colombia	7,378	1,570	1,989	3,670	150	14,757	12,896
Ecuador	1,120	200	480	900	20	2,720	2,384
Paraguay	196	49	47	68	6	366	621
Peru	4,710	1,742	1,839	4,455	80	12,826	12,355
Uruguay	2,202	1,274	1,350	4,590	90	9,506	9,271
Venezuela	12,400	3,245	6,443	18,167	291	40,546	33,429
TOTAL ABOVE	**70,465**	**21,487**	**35,425**	**99,222**	**3,327**	**229,926**	**205,814**
WESTERN EUROPE							
Belgium & Luxem.	8,850	1,440	9,340	10,700	715	31,045	26,824
Denmark	5,487	485	5,530	10,430	340	22,272	18,436
Finland	3,050	545	2,451	2,551	185	8,782	7,325
France	38,500	800	25,115	58,050	3,129	125,594	115,587
Germany, West	26,357	395	26,750	23,616	3,416	80,534	63,775
Greece	2,000	772	2,600	5,100	140	10,612	10,150
Iceland	470	30	800	700	30	2,030	1,840
Ireland	3,170	900	1,100	2,600	140	7,910	6,088
Italy, Trieste	12,300	1,449	13,800	46,800	1,281	75,630	74,594
Netherlands	8,000	2,500	11,704	18,900	693	41,797	37,090
Norway	2,796	333	6,736	8,764	270	18,899	15,905
Portugal	1,237	1,110	2,742	3,449	157	8,695	8,775
Spain	4,800	1,050	4,900	10,500	550	21,800	17,360
Sweden	9,469	3,600	20,887	24,493	784	59,233	47,265
Switzerland	4,500	310	7,170	2,100	300	14,380	12,335
United Kingdom	58,100	10,870	35,600	75,200	6,300	186,070	180,810
TOTAL ABOVE	**189,086**	**26,589**	**177,225**	**303,953**	**18,430**	**715,283**	**644,159**
MIDDLE EAST							
Bahrain	253	88	1,758	4,096	15	6,210	8,923
Iraq	1,370	1,450	1,690	4,100	70	8,680	6,760
Israel	1,600	2,200	1,400	5,100	100	10,400	7,836
Jordan	380	260	190	90	20	940	650
Kuwait	429	124	234	7,860	3	8,650	8,415
Saudi Arabia	1,186	250	2,100	9,660	20	13,216	14,450
Syria-Lebanon	2,200	1,200	3,500	2,800	90	9,790	6,330
Turkey	3,315	2,000	3,096	533	413	9,357	7,780
TOTAL ABOVE	**10,733**	**7,572**	**13,968**	**34,239**	**731**	**67,243**	**61,144**
ASIA							
Burma	800	400	400	250	60	1,910	1,460
Ceylon	1,200	700	1,450	3,100	50	6,500	5,550
Formosa	1,000	500	800	1,400	70	3,770	3,260
India	8,600	11,200	6,580	6,500	1,000	33,880	31,300
Indo-China	2,500	450	650	750	70	4,420	4,830
Japan	16,600	3,160	9,000	38,000	2,550	69,310	61,890
Malaya	3,500	700	6,300	13,300	200	24,000	22,270
Pakistan	1,400	1,500	2,300	4,600	200	10,000	9,300
Thailand	2,100	650	1,600	1,000	150	5,500	4,370
TOTAL ABOVE	**37,700**	**19,260**	**29,080**	**68,900**	**4,350**	**159,290**	**144,230**
AFRICA							
Algeria	2,500	560	2,600	5,300	170	11,130	10,420
Belgian Congo	1,700	200	1,000	70	150	3,120	2,720
Cameroons, French	450	100	150*	n.a.	30	730	620
Egypt	2,920	6,300	4,770	19,500	315	33,805	33,060
Ethiopia	400	40	60*	n.a.	40	540	490
Kenya	1,000	250	3,800*	n.a.	90	5,140	4,700
Liberia	100	30	40	—	5	175	275
Madagascar	450	90	170	30	40	780	725
Morocco, French	3,041	354	1,320	1,520	130	6,365	6,252
Nigeria	1,800	400	350	270	70	2,890	2,350
Rhodesia	1,680	290	600*	n.a.	120	2,690	2,408
Sudan	600	150	400	700	40	1,890	1,690
Tanganyika	500	200	650*	n.a.	30	1,380	1,090
Tunisia	770	275	800	1,300	50	3,195	3,683
Uganda	450	150	200*	n.a.	30	830	730
Un. South Africa	11,600	4,000	4,400	2,500	700	23,200	21,950
TOTAL ABOVE	**29,961**	**13,389**	**21,310**	**31,190**	**2,010**	**97,860**	**93,833**
OCEANIA							
Australia	26,267	3,797	9,979	12,596	1,317	53,956	46,109
Indonesia	4,350	5,550	6,000	7,000	250	23,150	18,254
New Zealand	6,600	200	1,900	2,200	250	11,150	10,450
Philippine Is.	5,370	1,540	3,040	3,500	300	13,750	12,450
TOTAL ABOVE	**42,587**	**11,087**	**20,919**	**25,296**	**2,117**	**102,006**	**87,263**
TOTAL ABOVE	**1,826,182**	**240,675**	**956,681**	**1,227,507**	**77,898**	**4,328,943**	**4,024,492**
COUNTRIES	**5,003**	**659**	**2,621**	**3,363**	**213**	**11,859**	**11,025**
Daily Average							

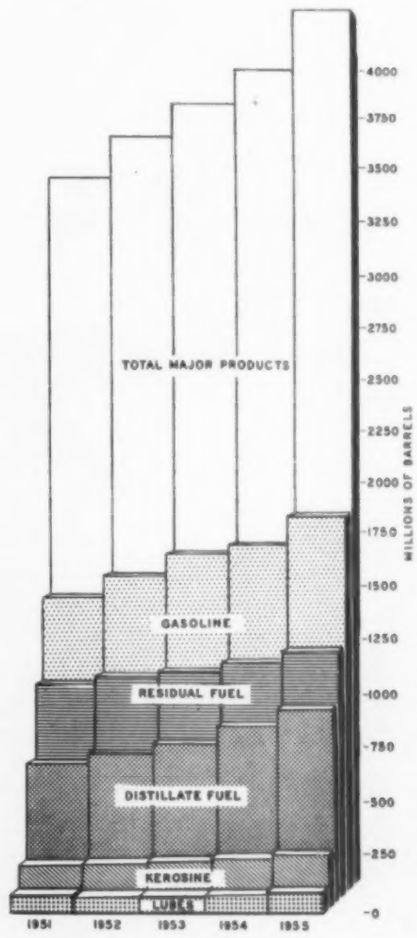
*Includes any residual fuel oil, quantities not available. n.a. Not available.

WORLD demand for major petroleum products increased 7.6% in 1955 according to data gathered by the U. S. Bureau of Mines and published as WPS No. 91 "World Petroleum Statistics—1955."

Smallest increases on a percentage basis were reported from Africa and North America. Europe, Asia and Oceania enjoyed the largest rates of growth in consumption.

In Oceania an increase of 14,743,000 barrels represented a rise of 16.9%. Asia's demand was up 11.1%, the Middle East 9.97% and Western Europe 11.04%. South American consumption rose 11.72%.

The Bureau of Mines report on major products demand does not include the U.S.S.R. or its satellites. Details of the report are given in an accompanying tabulation.



Ralph Morrow is currently an assistant process engineer in the process design section, engineering division, manufacturing department, Sun Oil Co.

Mr. Morrow worked for Foster-Wheeler Corp. in field construction of petroleum refineries from 1942 until joining the US Navy for World War II service in the South Pacific in 1944. From 1947 until he joined Sun in 1951, Mr. Morrow was a Foster-Wheeler project engineer. During this time, he spent three years in Europe as a resident engineer on erection of two large crude distillation units.

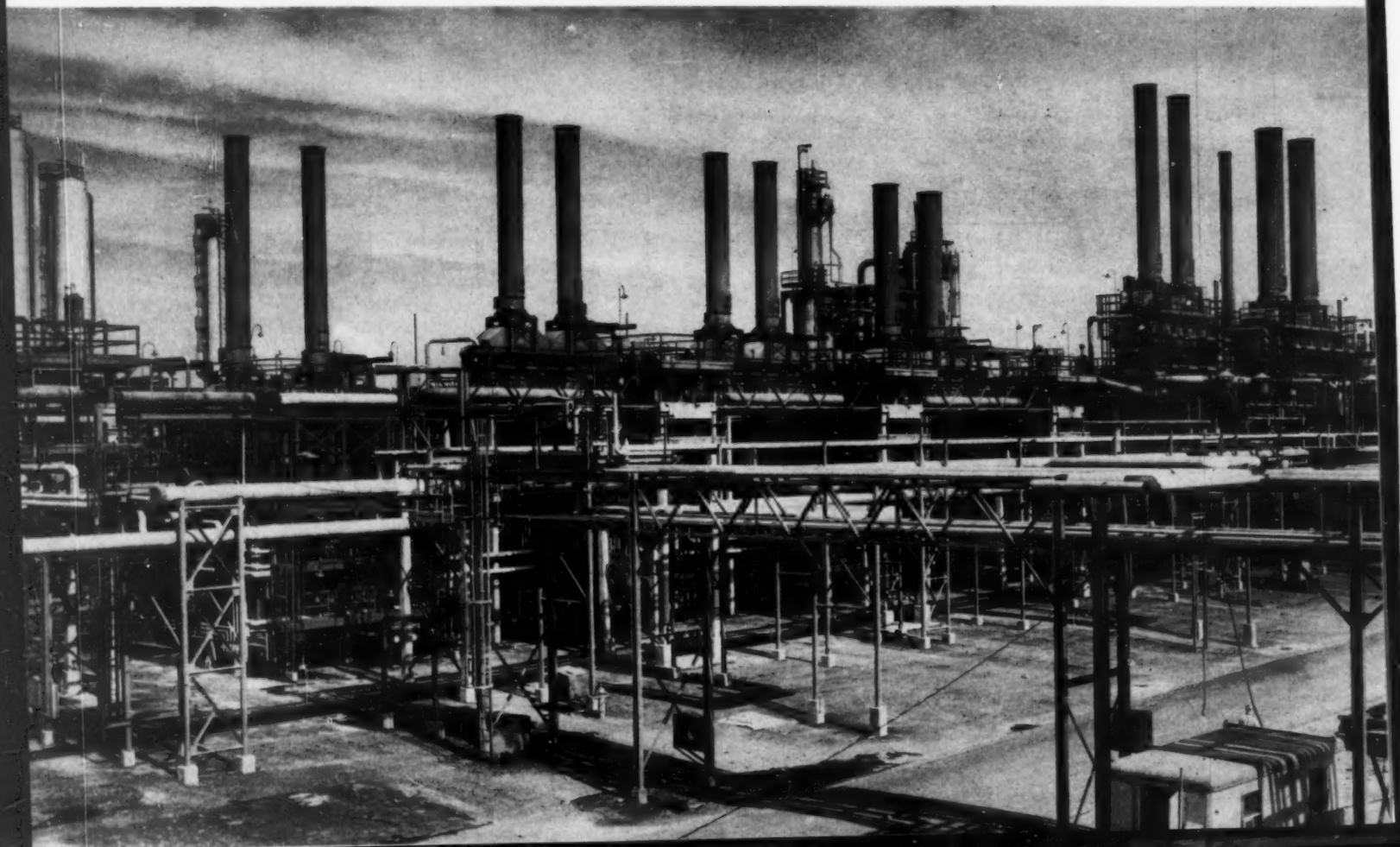
In the five years he has worked in Sun's engineering division, he has collaborated with other process engineers on design of new refining units and the redesign of existing ones. His process design work has included crude distillation units and a furfural extraction plant.

Double firing of vertically suspended tube banks is a feature of a new heater design employed at Sun Oil Co.'s Marcus Hook refinery. Tubes remain straight at high temperatures, and require no intermediate supports.

NEW PROCESS HEATER DESIGN

*by Ralph Morrow**

Group of Houdriformer heaters at Sun Oil Co.'s Marcus Hook (Pa.) refinery: They are used in conjunction with Sun's two Houdriformer units. Total design firing rate for this group of heaters is in excess of 400 million Btu's per hour.



An entirely new process heater design now offers the refiner a more efficient utilization of costly radiant-section tube surface. The principle involved is the double-firing of vertically-suspended tube banks.

The first heaters of this type were designed and built for use with a Houdriformer unit at Sun Oil Co.'s Marcus Hook (Pa.) Refinery. Four such heaters were placed in service by Sun in November 1953; and, except during 2 normal shutdowns for equipment inspection, have operated continuously to date.

Subsequently, three larger heaters of substantially the same design were built for use with a second Houdriformer, also at Sun's Marcus Hook refinery. Placed in service in August 1955, these latter 3 heaters are giving equally satisfactory performance.

A description of one of these heaters follows:

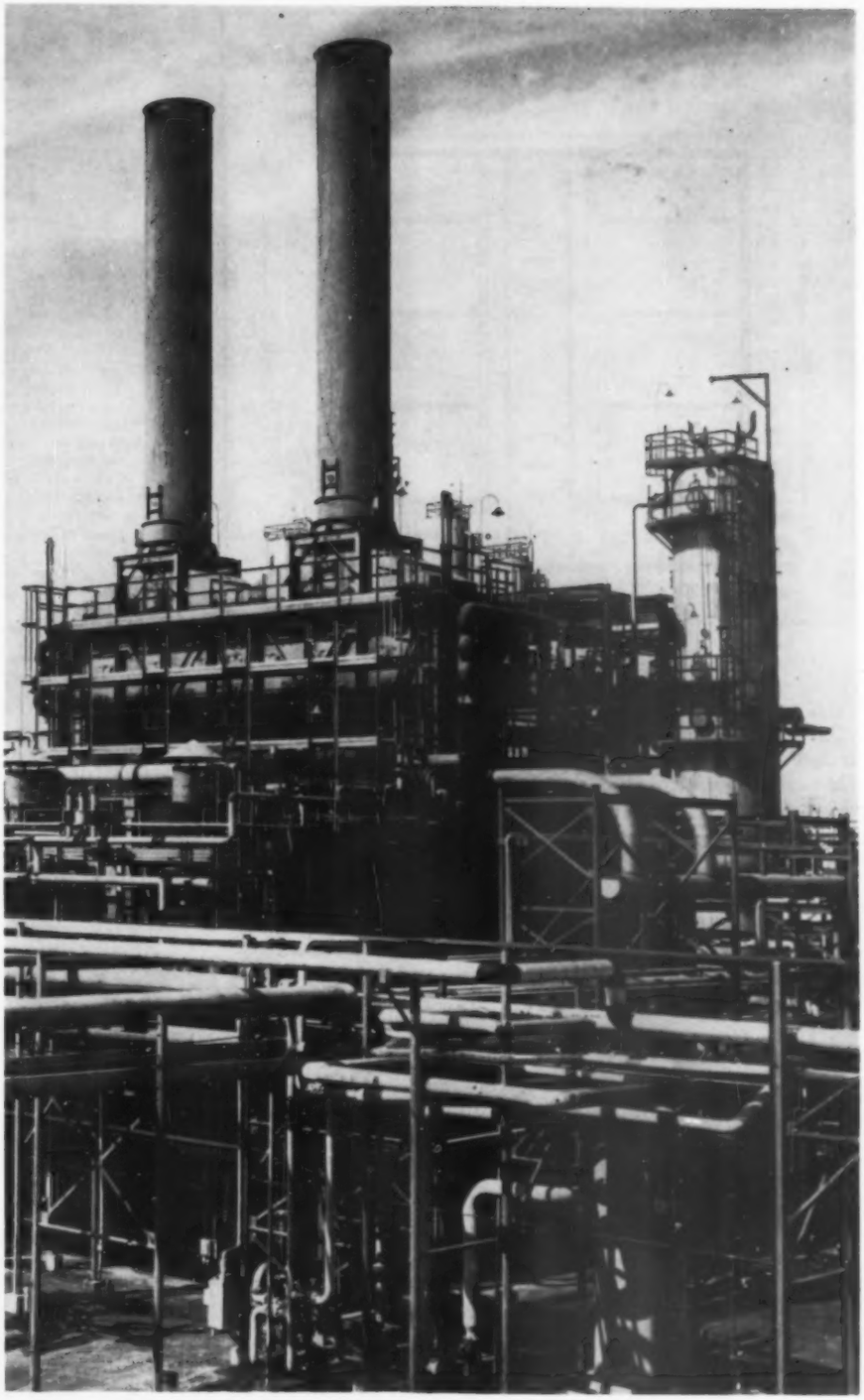
The process stream is heated entirely in the radiant section of the heater, where the tubes are arranged in banks or coils disposed in a vertical position (Fig. 1). Horizontally-mounted burners supplied with preheated air are located at several elevations midway between and on both sides of these vertical banks.

Sun Oil Co., Manufacturing Dept., Engineering Division.

Table I

Design Data for 18,000 B/SD Houdriformer Charge Heater

Radiant Section:	
No. of tube banks	8
No. of tubes	112
Size of tubes	6" x 5"
Surface, sq. ft.	5725
No. of burners	80
Type of burners	Nat. Airoil Oil & Gas
Length x Width x Height	42' x 42' x 33'
Firebox volume, c.f.	58,000
Convection Section:	
Bare surface, sq. ft.	4,320
Extended surface, sq. ft.	11,200
TOTAL	15,520
Design:	
Heat release, Btu/h	167,500,000
Air preheat, Btu/h	9,200,000
TOTAL	176,700,000
Radiant section duty, Btu/h	103,000,000
Rate, Btu/h/sq. ft.	18,000
Convection section duty, Btu/h	44,700,000
Rate, Btu/h/sq. ft.	2,880
Total steam generation, lbs./h.	58,500
Steam to air preheaters, lbs./h	12,000
Net steam production, lbs./h	46,500
Net efficiency, %	82.7
Excess air, %	25
Stack temp., °F	665°



This 18,000-bbl-per-stream-day Houdriformer charge heater at Sun Oil Co.'s Marcus Hook (Pa.) refinery converts naphtha into high-octane gasoline (see Table I for design data).

The direction of firing is thus in a vertical plane parallel to and on both sides of the plane of the tube bank (Fig. 3). Since each of the tubes in each bank stands in the same vertical plane and receives an equal amount of heat from both sides, there is a minimum variation in the circumferential heat density around the tubes. Also, because of the location of burners at several different elevations, the longitudinal variation in heat density along the tubes is negligible.

The convection section of the heater, which has a horizontal tube arrangement, is situated on top of and lengthwise to the radiant section. The path of the exit flue gases from the firebox is upwards through the convection section, discharging through two top-mounted steel stacks. This convection section is designed to generate 450 psig steam, part of which is diverted to supply the burner air preheat, and the balance of which is used for other process require-

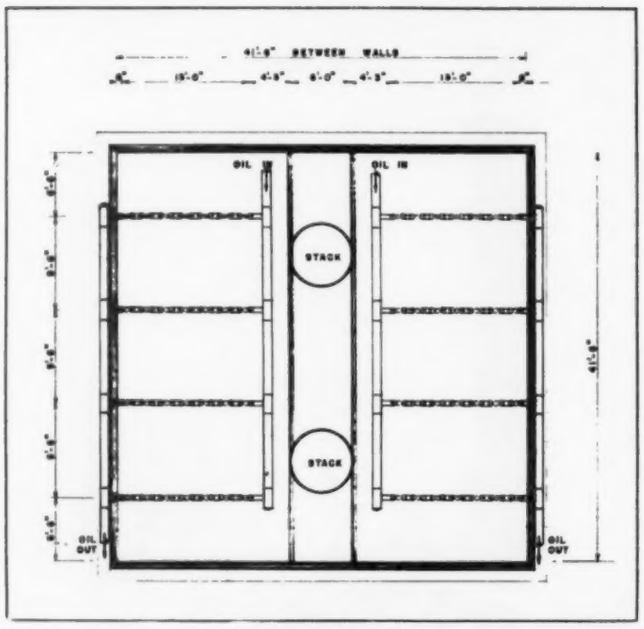


Fig. 1-A Sectional Plan

Table 2

Effectiveness of Single-Row Tube Banks

POINT NO.	I CONVENTIONAL WALL TUBES: Radiating Plane on one side, refractory on other side; tube spacing at 2 diameters. DIRECT	RERAD.	TOTAL	II DOUBLE-FIRED VERTICAL TUBES: Radiating Planes on both sides; tube spacing at 2 diameters. DIRECT FROM PLANE 1	DIRECT FROM PLANE 2	TOTAL
1	1.000	0	1.000	1.000	0	1.000
2	0.918	0	0.918	0.918	0	0.918
3	0.676	0.027	0.703	0.676	0.080	0.756
4	0.336	0.115	0.451	0.336	0.336	0.672
5	0.080	0.232	0.312	0.080	0.676	0.756
6	0	0.315	0.315	0	0.918	0.918
7	0	0.342	0.342	0	1.000	1.000
8	0	0.315	0.315	0	0.918	0.918
9	0.080	0.232	0.312	0.080	0.676	0.756
10	0.336	0.115	0.451	0.336	0.336	0.672
11	0.676	0.027	0.703	0.676	0.080	0.756
12	0.918	0	0.918	0.918	0	0.918
TOTAL	5.020	1.720	6.740	5.020	5.020	10.040
AVERAGE	0.418	0.143	0.562	0.418	0.418	0.837

Maximum flux / Average flux = 1.000 / 0.562 = 1.779

Direct Radiation = $\frac{0.418\pi D}{2D}$ = 0.657

Reradiation = $\frac{0.143\pi D}{2D}$ = 0.225

Total effectiveness = 0.882

Maximum flux / Average flux = 1.000 / 0.837 = 1.195

Direct Radiation from Plane 1 = $\frac{0.418\pi D}{2D}$ = 0.657

Direct Radiation from Pane 2 = $\frac{0.418\pi D}{2D}$ = 0.657

Total effectiveness = 1.314

ments. Actual design data are given in Table 1.

An analysis of the principle of double-firing the radiant-section tubes is given in Fig. 2. Shown is a graphical determination of the heat-flux pattern around the individual tubes in a conventional wall-tube heater design as compared to the pattern around double-fired tubes[1,2].

It will be noted in Table 2 that, for a conventional wall-tube design, with tube spacing at 2 diameters, the ratio of the maximum heat flux on the face of the tubes to the average heat flux around the tubes is approximately 1.8:1. For double-fired tubes at the same spacing, this ratio of maximum heat flux to average heat flux is reduced to approximately 1.2:1.

Of greater importance, however, is the fact that the total effectiveness of the tube banks in a wall-tube design is found to be only 0.882 (i.e., 88.2% of a black body). Double-firing of the vertical tube banks increases their effectiveness by almost 50% to a value of 1.314.

From this concept, it follows that, for a given maximum heat flux on the face of the tubes, only two-thirds the total tube surface must be employed in this new design as is required for a wall-tube design. Another way of stating this is that two tubes fired on both sides will give the same radiant absorption as three tubes fired only on one side at the same rate.

Further, it is apparent that, for a given pressure drop and the same maximum heat flux, the tube-wall temperature will be lower in the double-fired vertical tube arrangement, than in a wall-tube design be-

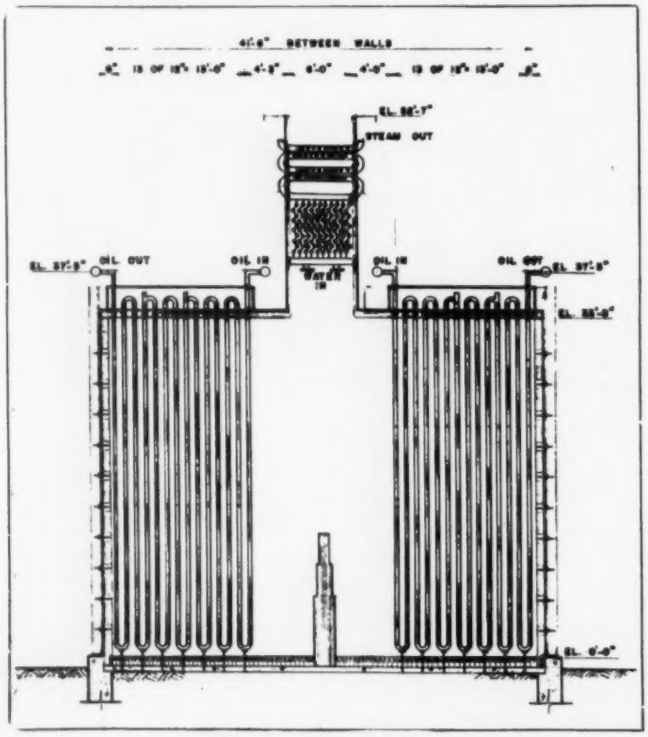


Fig. 1-B Sectional Elevation

Table 3

Tube-Wall Temperature Survey
18,000 B/SD Houdriformer Charge Heater

Location	Coil No. 1	Coil No. 2	Coil No. 3	Coil No. 4
North side:				
Middle tube	941°	978°	960°	892°
Outlet tube	1055°	1025°	1038°	1038°
South side:				
Middle tube	934°	973°	923°	863°
Outlet tube	1072°	1038°	1010°	1016°
Operating Conditions:				
Charge rate		303,000 lbs./h Naphtha Vapor, including 9.8 wt. % hydrogen		
Inlet temperature		640°F.		
Outlet temperature		910°F.		
Calculated duty		83,000,000 Btu/h		
Surface		5725 sq. ft.		
Average rate		14,500 Btu/h/sq. ft.		
Maximum rate (i.e. 1.2:1)		17,400 Btu/h/sq. ft.		
Coil Description:		8 pass arrangement 6" x 5" tubes 2¼ Cr 1 Mo		

Calculation of "clean" tubewall temperature:

For film coefficient, from McAdams (3)

formula $h = 0.0144 \times \text{Spec. Ht.} \times G^{0.8}/D^{0.2}$

where Spec. Ht. = 1.013, G = 277,000 lbs./h/sq. ft. and D = 5"/12

$h = 0.0144 \times 1.013 \times (277{,}000)^{0.8}/(0.417)^{0.2} = 390$

Film drop = $\frac{17{,}400 \times 6"/5"}{390} = 53.5°$

For metal, where k = 200 Btu/h/sq. ft./inch/°F.

Metal drop = $\frac{17{,}400 \times 0.5}{200} = 43.5°$

"Clean" tubewall temperature = Oil temperature + film drop + metal drop
= 910° + 53.5° + 43.5°
= 1007°F.

cause the mass velocity will be greater while the tube travel is less. This is of value in obtaining maximum heat transfer within a range of safe operating conditions.

Evidence that the foregoing analysis is justified has been obtained in actual plant operation. Table 4 gives a comparison between design and survey data for the first group of four heaters built at Marcus Hook. Examination of the data will show that the radiant extraction obtained is well within the range to be expected when account is taken of the rate of firing, fuel heating value, excess air, etc.

Table 3 gives the results of a tube-wall temperature survey made on the second Houdriformer charge heater. Shown is the method of calculating the "clean" tube-wall temperature of 1,007 F, based upon a maximum flux rate of 17,400 Btu per hour per square foot. Actual measured temperatures ranged from 1,010 F to 1,072 F. It is interesting to note that subsequent internal inspection of the tubes showed them to be scaled, with the pattern of scaling identifiable with the higher tube-wall temperatures.

These heaters have demonstrated their flexibility in operation to the extent that, when radiant-section duty requirements have been low, large quantities of steam have been generated in the convection sections by increasing the per cent excess air. It has also been found that the use of preheated air to the burner is optional with regard to the efficiency of the heaters.

Other process advantages offered by this new design include the ease of making series-parallel coil arrangements. With the proper attention to coil arrangement, any shape time-temperature curve may be obtained easily.

The design lends itself readily to firing with either oil or gas. Burners may be individually controlled, or automatic instrumentation of whole banks of burners may be used.

This new type of heater has many structural and mechanical advantages. Because the vertical tubes are suspended at the top and are merely guided at the bottom, they remain perfectly straight at high-temperature levels. This suspension-guide arrangement also eliminates the necessity for intermediate tube supports, which are often expensive to purchase and costly to maintain.

The top tube sheets are designed with slotted holes, and this makes it feasible to completely shop-fabricate and heat-treat the coils prior to their installation in the heater as assembled units. The coils, of course, can be removed in the same manner for replacement and repair. Ground space requirements for tube removal are very small.

It should be noted that, for services requiring frequent internal inspection and maintenance of the tubes, this heater may easily be elevated and bottom header boxes provided.

The original development of the design of these heaters was done jointly by the Alcorn Combustion Co. and Sun Oil Co.'s engineering division. Permission of both companies was obtained to publish the design and operating data contained in this article. END

Table 4

Design and Survey Data for Double-fired Vertical Tube Heaters

Description	H-1 Design	H-1 Actual	H-2 Design	H-2 Actual	H-3 Design	H-3 Actual**	H-4 Design	H-4 Actual
Radiant Section:								
Charge, lbs./h	156,200	186,500	156,200	186,500	156,200	186,500	156,200	186,500
Temp in, °F.	800°	803°	760°	803°	810°	863°	870°	901°
Temp. out, °F.	950°	950°	970°	936°	970°	940°	970°	947°
Duty, mm Btu/h	20.000	29.076	29.700	28.026	24.100	10.277	15.400	11.855
Rate, Btu/h/sq. ft.	7,180	10,440	14,960	14,120	15,160	6,460	13,940	10,730
% extraction	69.7	61.4	61.7	58.9	62.3	55.9	62.8	52.6
Exit gas temp., °F.	1090°	1390°	1395°	1520°	1405°	1290°	1355°	1505°
Convection Section:								
Duty, mm Btu/h	3.960	10.359	9.220	10.764	7.170	4.274	4.410	5.621
Steam generation, lbs./h	5,190	12,700	12,080	13,200	9,400	5,200	5,780	6,900
Rate, Btu/h/sq. ft.	740	1,925	2,400	2,790	2,540	1,515	2,080	2,650
U, Btu/h/sq. ft./°F.	2.5	4.4	4.8	4.8	5.0	3.7	4.2	4.5
Combustion:								
Fuel gas, SCFH	40,200	33,615	67,100	33,570	54,100	13,320	34,250	16,030
Net heating value, Btu/cf.	680	1360	680	1360	680	1360	680	1360
% excess air	15	17	15	21	15	57	15	47
Stack temp., °F.	600°	609°	740*	722°	740*	615°	740*	743°
Overall:								
Heat release, mm Btu/h	27.300	45.716	45.700	45.655	36.800	18.115	23.300	21.801
Air preheat, mm, Btu/h	1.390	1.628	2.320	2.038	1.870	0.276	1.180*	0.733
TOTAL	28.690	47.344	48.020	47.693	38.670	18.391	24.480	22.534
% Efficiency	82.5	82.7	80.0	80.5	80.0	78.8	80.0	76.8
% Stack loss	13.5	13.3	17.3	16.5	17.2	18.2	17.2	20.2
% Setting loss	4.0	4.0*	2.7	3.0*	2.8	3.0*	2.8	3.0*
TOTAL	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

*Assumed.
**Upset reactor. Only half-firing.

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[2] *Mekler, L. A., and Fairall, R. S., Petroleum Refiner, Vol. 31, No. 12 (1952).*
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Fig. 2 Heat-Flux Distribution Around Tubes in Single-Row Banks [1,3]

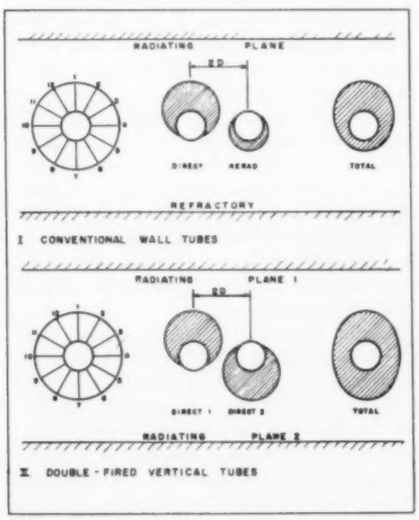
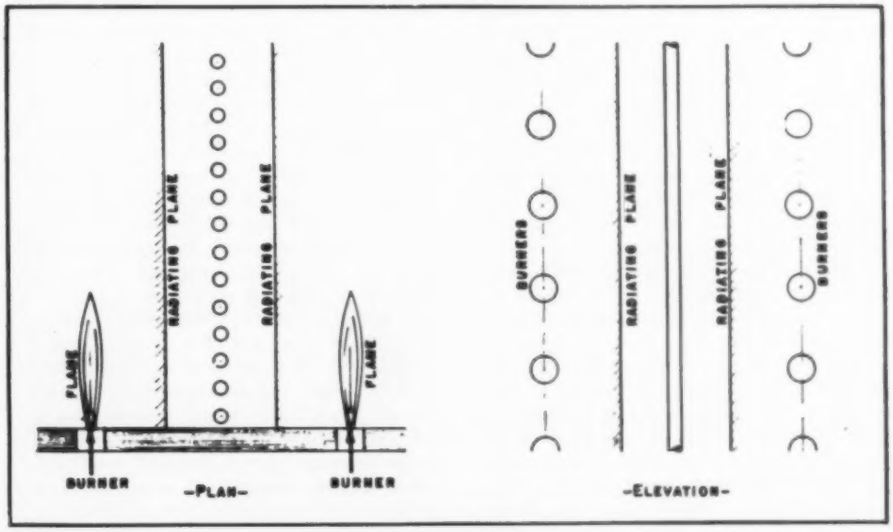


Fig. 3 Double Firing of Vertical Tubes



The threat of coal shortage, difficult and expensive mining, and the shrinking fuel base of the European part of Russia are causing the expansion of

THE SOVIET GAS INDUSTRY

by G. G. Rosu

RUSSIA's proved gas reserves may be as high as 15 trillion cubic feet and her ultimate reserves enormous, but actual production is not commensurate with the reserves. Gas production is poorly organized; the amount wasted annually is very large; and chemical processing of natural gas is very retarded by western standards. Until last year the gas industry was the least known and developed sector of the Soviet fuel picture. The current Five-Year Plan set itself the task to quadruple gas production by 1960, i.e., to raise it to 1,412.4 billion cubic feet, from 363.7 billion cubic, which represents roughly the caloric value of 73 million barrels of fuel oil. With the exception of armament production (the goals of which are unknown), this is the most ambitious target in the history of Soviet planning. During the current plan, Russia hopes to lay more gas pipelines, and of a larger diameter, than there were in all of Russia in 1955. Yet this ambitious program will alter only slightly the Soviet energy picture if it is accomplished. The contribution of gas will go up to a mere 5.3%, from 2.5%, in 1955, of the fuel balance by 1960. The corresponding percentages in the USA are 25.9% and 23.7%, respectively.

Up to 1946 gas was used only locally, and the longest pipelines were those located in the former Polish lands annexed by Russia after the last war. The pressing demands for fuel caused by a planned industrial expansion of 65% during the 1956-60 period spurred the development of gas on a broader basis. Pipelines will be completed to carry gas to industrial centers from fields located more than 800 miles away, through the territory of two or three Soviet republics.

Behind this precipitous gas plan, which aims at harnessing this fuel for industrial uses, lie three reasons.

The first reason stems from the tightness of fuels and energy for industry in European Russia and in the Urals. In these regions is located most of the Soviet heavy industry. Local fuel output has not kept pace with repeated expansions in plant capacity—with the result that greater quantities must be transported overland from distant areas. As this feat becomes increasingly difficult, Soviet planners had no alternative except to develop the gas deposits found in these areas, and to bring in gas here from more distant fields.

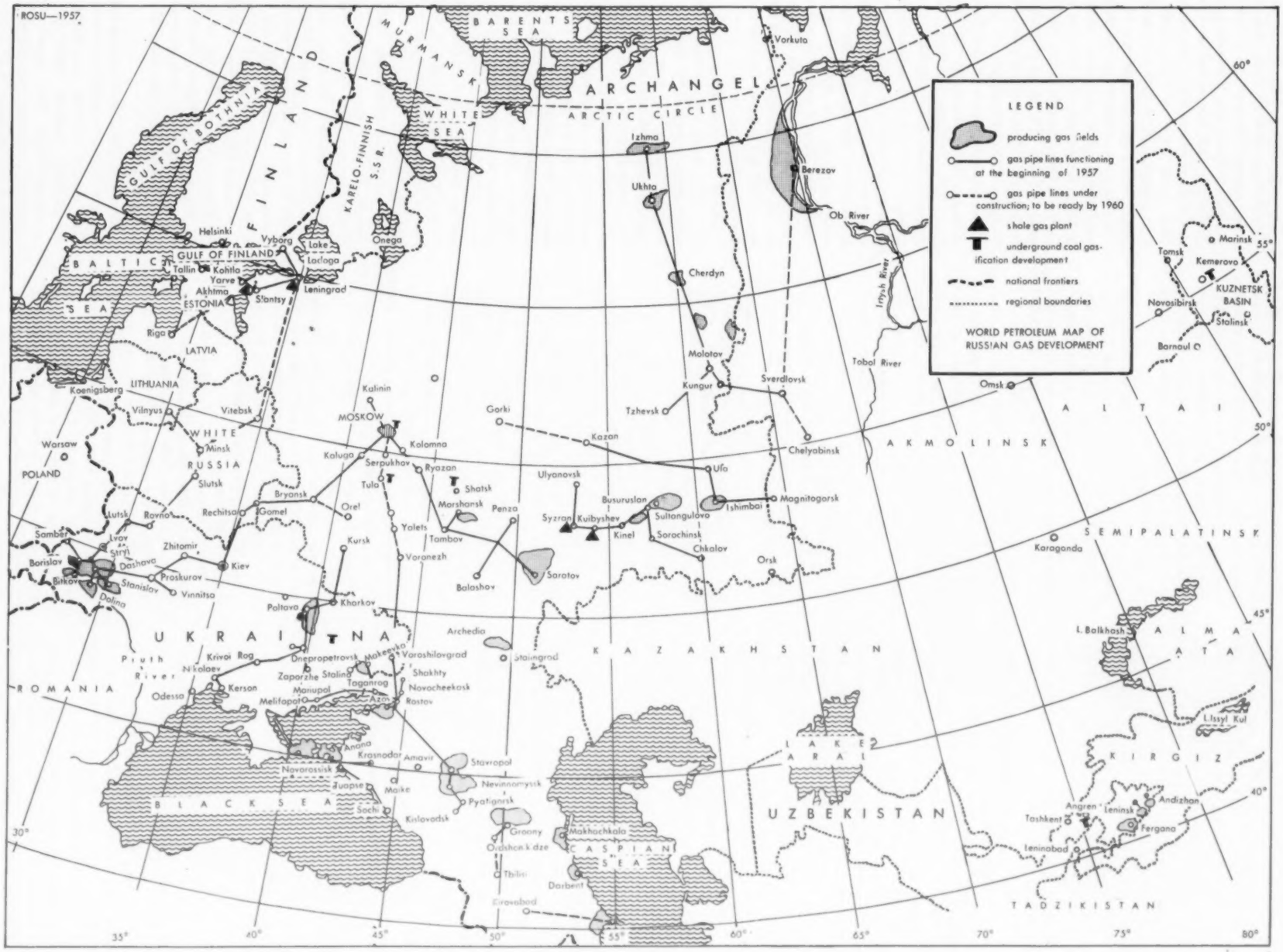
The second reason is more serious than the first, as it involves solving a fuel crisis long postponed. The current Five-Year Plan is featured by a switch to cheaper fuels. Inasmuch as 72% of the fuel required by her industrial activity still is derived from coal, Russia has increasing difficulty to mine enough to fuel the industrial machinery. The Donbas miners almost daily are scolded for not fulfilling the coal-production quotas and thereby causing a slowdown in industrial activity in the European part of the Soviet Union. Opening and equipping of new coal mines, and deepening of existing ones, is a slow and costly job. Additional cost arises also from the necessity to transport huge quantities of coal over longer distances by an overburdened railway system. According to accounts published by the Soviet press, it now takes twice as long to open up a coal mine as a new oil or gas field. In Moscow, natural gas pumped from Saratov costs only one-seventh as much as fuel oil and coal transported shorter distances.

Finally, the third reason stems from the need to conserve capital. The main feature of Soviet planning is to solve one task at a time. Gas reserves were known long ago to be very large and spread over wide areas. The objection raised, however, during previous "plan" periods was that their development was bound to cause high initial costs for drilling, pipelines, and distribution installations. These costs were thought earlier to be too high a burden on available funds. However, as Russia reached the point of diminishing returns with her coal mining, she has turned to natural gas because its initial costs are less burdensome.

This trend is expected to continue because natural gas, like electric power, has become, since 1955, subject to the so-called "prospective planning," directed by the former Soviet Minister of Petroleum Industry, Nikolai Babakov. Its purpose is to blueprint industrial growth free of bottlenecks for the next 15 years.

The Soviet press is presently much concerned with the gas industry. Recent official criticisms have revealed many shortcomings, but also the determination of Soviet authorities to improve gas-industry efficiency. These criticisms suggested mismanagement and wastage in the gas industry. Here are some illustrative examples picked from the Soviet press.

On the Apsheron peninsula alone (old Baku) 6 billion to 7 billion cubic feet of gas is allowed to escape into the air annually because of lack of gathering facilities. In adjoining Azerbaijan some 15 billion cubic feet of gas is vented every year, and an equal volume lost from the offshore developments in the Caspian Sea. At the


ROSU—1957
LEGEND
producing gas fields
gas pipe lines functioning at the beginning of 1957
gas pipe lines under construction; to be ready by 1960
shale gas plant
underground coal gasification development
national frontiers
regional boundaries
WORLD PETROLEUM MAP OF RUSSIAN GAS DEVELOPMENT
BARENTS SEA
MURMANSK
ARCHANGEL
ARCTIC CIRCLE
WHITE SEA
FINLAND
KARELO-FINNISH S.S.R.
GULF OF BOTHNIA
GULF OF FINLAND
BALTIC SEA
ESTONIA
LATVIA
LITHUANIA
WHITE RUSSIA
POLAND
ROMANIA
UKRAINA
BLACK SEA
CASPIAN SEA
KAZAKHSTAN
UZBEKISTAN
KIRGIZ
TADZIKISTAN
ALTAI
AKMOLINSK
SEMIPALATINSK
ALMA ATA
KUZNETSK BASIN
LAKE ARAL
Vorkuta
Izhma
Ukhta
Berezov
Ob River
Cherdyn
Irtysh River
Tobol River
Molotov
Kungur
Sverdlovsk
Tzhevsk
Omsk
Tomsk
Marinsk
Kemerovo
Novosibirsk
Stalinsk
Barnaul
Helsinki
Vyborg
Lake Ladoga
Onega
Tallin
Kohtla
Yarve
Akhtma
Slantsy
Leningrad
Riga
Koenigsberg
Vilnyus
Vitebsk
Minsk
Warsaw
Kalinin
MOSKOW
Gorki
Kazan
Chelyabinsk
Kaluga
Kolomna
Serpukhov
Ryazan
Tula
Shatsk
Ulyanovsk
Ufa
Bryansk
Orel
Marshansk
Penza
Busuruslan
Sultangulovo
Ishimbai
Magnitogorsk
Gomel
Rechitsa
Lutsk
Rovno
Syzran
Kuibyshev
Kinel
Sorochinsk
Chkalov
Orsk
Karaganda
Sambor
Lvov
Stryi
Zhitomir
Kursk
Voronezh
Tambov
Yalets
Saratov
Balashov
Borislav
Dashava
Kiev
Proskurov
Bitkov
Stanislav
Vinnitsa
Dolina
Poltava
Kharkov
Archedia
Stalingrad
Pruth River
Krivoi Rog
Dnepropetrovsk
Makeevka
Voroshilovgrad
Nikolaev
Zaporzhe
Stalino
Shakhty
Odessa
Kerson
Manupol
Taganrog
Novocheekask
Melitopol
Azov
Rostov
L. Balkhash
L. Issyl Kul
Anapa
Krasnodar
Armavir
Stavropol
Novorossisk
Tuapse
Maike
Nevinnomyssk
Pyatigorsk
Sochi
Kislovodsk
Groony
Ordshonik dze
Makhachkala
Tbilisi
Darbent
Krasnovodsk
Aral Sea
Angren
Leninsk
Andizhan
Tashkent
Fergana
Leninabad
30°
35°
40°
45°
50°
55°
60°
65°
70°
75°
80°
60°
55°
50°
45°
40°

same time Baku refineries are fueled with oil transported all the way from the Ural-Volga region. A Soviet official put the waste of natural gas in 1955 at 125 billion cubic feet, which is roughly the equivalent of 5 million tons of coal. At Stalingrad 0.5 billion cubic feet of gas is vented annually because no outlets are found. The 16-mile Atsheda-Stalingrad gas pipeline is used at only 5% to 10% of its capacity, and even that volume is not being used economically. Wellhead gas is wasted in large quantities, and the petroleum ministry is being blamed for allegedly impeding any plan aiming at collecting this gas.

Production of natural gasoline and of LP-Gas is small. How retarded is the petrochemical industry based on natural gas was gathered from Mr. Khrushchev's speech delivered last February at the 20th Soviet Congress when he stated that 2 million tons of grains are wasted every year for manufacturing industrial alcohol; and 400,000 tons of edible fats and oil are used for manufacturing soap, detergents, lubricants, etc. Mr. Khrushchev went on to express his hope that, by 1960, this "waste of food" will be substituted entirely with petrochemicals.

A considerable amount of gas is being used for repressuring and secondary-recovery purposes in Russia. As this gas is not delivered to consumers outside the oil industry, it is not computed, and thus not included in the annual gas-production figures published by the Soviet government. The same goes for the natural gas burned for producing carbon black, of which an appreciable quantity is manufactured in the Soviet Union.

In official production figures dry natural and casinghead gas, as well as artificial gas obtained as a byproduct from the processing of coal and shale, are limped together. The following tabulation eliminates byproduct gas to show only marketed production of natural gas:

RUSSIA'S NATURAL AND CASINGHEAD GAS PRODUCTION
(Billions of Cubic Feet)

1946	60.0
1947	74.4
1948	80.4
1949	82.4
1950	123.6
1951	133.5
1952	136.1
1953	151.1
1954	164.7
1955	197.6
1956	270.0 (estimated)
1960	1,283.3 (Plan)

The target for 1956 provided for a total gas production of 459 billion cubic feet, of which natural and casinghead gas may amount to 270 billion cubic feet.

For 1960, the gas-production target from all sources is 1,412.4 billion cubic feet, of which production of natural and casinghead gas should be 1,285.3 billion cubic feet. While coal and shale gas in 1955 represented 46% of the total production, it is planned to drop in 1960 to only 9%.

It is difficult to predict the extent to which the targets set by the current plan will be fulfilled. If past experiences with Soviet gas plans are taken as a yardstick, their results are not encouraging to optimistic predictions. In addition, the government appears currently to be having difficulties in realizing some of its ambitions. There have been disappointments in the past.

The fourth Five-Year Plan set a target of 296.6 billion cubic feet of gas in 1950. Of this, 229.5 billion cubic feet was to be natural gas. The actual production in 1950 was 190 billion cubic feet, of which natural gas contributed only 123.6 billion cubic feet. The target was fulfilled by only 82%.

The fifth Five-Year Gas Plan was even worse. It provided for an 80% increase in the total gas production in 1955 as compared with 1950, or 533.9 billion cubic feet from all sources. The actual increase in 1955 was only 68%, as follows:

	Billions of Cubic Feet
Dry natural gas	151.3
Casinghead gas	46.3
Coal and shale gas	166.1
Total:	363.7

Russia's oldest and, apparently, best organized gas fields are those located in Transcarpathia, a new name given to the former Polish territory incorporated in 1944 into western Ukraina.

The Dashava field was discovered in 1919 and, until 1940, yielded a cumulative production of 60 billion cubic feet. It produces from 3 horizons, from depths between 1,090 ft and 2,200 ft. The initial pressure varies from 100 psi to 880 psi. In 1938 the Opary field was discovered which, actually, is an extension of the Dashava. Both fields are producing dry gas which is characteristic for the Precarpathian region. Their current production may be estimated at 20 billion to 25 billion cubic feet per annum. Following extensive geological exploration in this area carried out between 1947 and 1953, their proved reserves have increased greatly. The Dashava-Opary fields pump today more gas to Moscow than does the much discussed Saratov field.

South of Dashava, along the 49th parallel, are located the Dolina, Rypne, Majdan, and Starunia gas fields where new horizons have been struck during the past 3 to 4 years. These deposits yield dry gas at an average pressure of 60 atm.

West of Dashava lies the Boryslav gas field which, although quite extensive, lacks natural pressure. This causes the gas to be used only in the neighboring gasoline plants and as fuel for the Boryslav refining center. Boryslav yields wet gas with a gasoline content of 6 grains per cubic foot (approximately 0.175 gal per MCF).

Southeast of Boryslav lies the Bitkov-Pasiecna wet-gas deposits which, prior to the last war, were thought to be nonindustrial. They were reopened in 1941, and have been producing even since.

Although known for several decades, the often-mentioned Saratov gas area started to be developed on an industrial scale only after 1942. Subsequent prospecting determined a gas area of more than 50 square miles around Saratov, on which the main producing fields are Yelshanka, Kurdyum, Teplovka, and Stepnovodsk—where considerable reserves were discovered in 1954. They yield a gas of high purity and of a high caloric value (240 calories per cubic foot). The potential reserves of this area are very great. However, lack of outlets has limited their production to some 50 gas wells at the present time. The pipeline connecting Saratov with Moscow since 1947 has been using 10% to 15% of its carrying capacity because of delays in completion of distribution and burning facilities.

Third largest reserve is the North Caucasian gas area, discovered in 1952 around Stavropol. Present producing fields are located at Nevinnomyssk, but further areas will be developed as soon as the Stavropol-Moscow pipeline is completed. The vast reserves of this area obviously justify the laying of this pipeline (Russia's longest gas-carrying project) which is meant to supply on its way dozens of towns and industrial centers. Stavropol, in the not too distant future, may become the second largest supply source for the fuel-hungry provinces of European Russia.

Fourth in importance is the gas area stretching along the northern shores of the Azov Sea through the Donets basin in Poltava. During the last Five-Year Plan much geological work was done in this area. The major discovery is the Shebelinsk field, from which a pipeline carries gas to Kursk. In the area extending from Poltava to Kharkov there are many gas seepages, burning like torches for a long time without being developed for neighboring industries which are short of fuel.

On the southern shores of the Azov Sea there is the known gas field of Anapa on the Taman peninsula, which extends into the Kuban and Kertch peninsula. Only a fraction of these considerable gas reserves has been developed.

In the Ural-Volga basin (the so-called "second Baku") there are three major gas developments. The first is the Ukhta-Pechora gas area in the Komi republic, with main fields at Izhma and Ukhta. Further south lie the gas deposits bordered by the Kolva and Kama Rivers and the Ural Mountains. The only development known here is the Cherdyn fields on the banks of the Kama River. As this gas area is located on the Cis-Ural Upper Paleozoic trough where exceptionally rich oil deposits have been discovered, its gas reserves also must be significant.

More important, however, seems to be the new gas discovery made during the 1951-55 plan around Ishimbai and Sterlitamak, in the Bashkir republic. Both are also oil-producing fields. The reserves here are, apparently, of such magnitude that they justified the building of a large gas-transportation system. One pipeline crosses the Bashkir and Tatar republics, and now is

(Continued on page 64)

OIL CAPITAL UP

THE huge and continuously growing sums required by the industry to make available facilities to supply the Free World's voracious appetite for oil products since the end of World War II are revealed in a comprehensive study published at the end of 1956 by The Chase Manhattan Bank. A gross Free World investment in petroleum facilities of $63 billion to the end of 1955 accompanied a daily rate of petroleum consumption of 14.4 million barrels. More than $40 billion of this investment, or 64%, was required by the oil industry of the United States alone, whose energy needs today are supplied two-thirds by oil products.

The huge program of rehabilitation and expansion undertaken by the petroleum industry throughout the Free World following World War II increased the industry's gross investment in fixed assets by 174%—from $23 billion at the end of 1945 to $63 billion at the close of 1955. During the same period the daily rate of petroleum consumption in the Free World expanded from 7.1 million barrels in 1946 to 14.4 million barrels in 1955, or more than 100%.

Capital expenditures by the industry during the postwar years, 1946-55, amounted to $56 billion. About $38 billion, or 68%, went for properties and plants in the United States; while $18 billion, or 32%, was spent for facilities in foreign areas. The total outlay was distributed by departments of the business as follows: 59% for production facilities, 13% for transportation, 16% for refining, and 12% for marketing.

More than $40 billion, or 64%, of the total gross investment at December 31, 1955 employed by the industry was located in the United States. The overall investment of $63 billion was divided among departments as follows: production 48%, transportation 17%, refining 20%, and marketing 15%.

Of the investment of $23 billion in the Free Foreign countries, US enterprises contributed about $8 billion, or 35%. The participation of American oil companies represented 54% of the industry's total gross fixed assets in Canada, 61% in Venezula, 26% in Western Europe, 47% in the Middle East, and 22% in other countries. Their share in free foreign operations for 1955 was 55% of production and 40% of refinery runs.

The industry is, to a large extent, self-financing. Of the $24 billion of capital spent in the United States for petroleum facilities during the 5 years 1951-55, $20 billion came from retained earnings and capital extinguishment charges—with only $4 billion provided primarily by the capital markets. This pattern of reinvestment of earnings, the authors of the survey feel, is essential to support the present and anticipated growth of the industry.

The report says the growth of the petroleum industry is usually measured by the expansion of its physical aspects, such as crude-oil production or petroleum consumption. The financial counterparts, now available, can also be used for this purpose. As shown in Table I, comparing the year 1955 with 1946, consumption in the Free World increased 2.04 times, whereas gross investment expanded 2.57 times.

A summary of gross investments by departments and areas at December 31, 1956 and December 31, 1955 is given in Table II from the report.

The report analyzes the industry's financial and operating data "three-dimensionally" in terms of time, area, and departments of the business. The information covering the financial aspects is based on a large sampling of accounting data collected from oil companies operating all over the world, and represents about three-fourths of the entire industry.

Table I GROWTH OF FREE WORLD PETROLEUM INDUSTRY

	1946	1955	1955 as Multiple of 1946
	Million Dollars		
Gross Investment in Fixed Assets (Year-End)			
United States	17,700	40,400	2.28
Free Foreign	6,900	22,900	3.32
TOTAL	24,600	63,300	2.57
Capital Expenditures			
United States	2,000	5,600	2.80
Free Foreign	725	2,645	3.65
TOTAL	2,725	8,245	3.03
	Thousands of Barrels Per Day		
Crude-Oil Production			
United States	4,751	6,807	1.43
Free Foreign	2,198	6,906	3.14
TOTAL	6,949	13,713	1.97
Crude Runs to Stills			
United States	4,740	7,480	1.58
Free Foreign	2,043	6,070	2.97
TOTAL	6,783	13,550	2.00
Petroleum Consumption			
United States	4,912	8,415	1.71
Free Foreign	2,179	6,018	2.76
TOTAL	7,091	14,433	2.04

Table II DISTRIBUTION OF GROSS INVESTMENT IN PROPERTY, PLANT AND EQUIPMENT

Department	12/31/46	12/31/55	12/31/46	12/31/55
	Million Dollars		% of Total	
Production	11,935	30,610	48.5	48.4
Pipelines	1,580	4,325	6.4	6.8
Tankers	2,375	6,300	9.7	10.0
Refineries and Chemical Plants	4,220	12,490	17.2	19.7
Marketing	3,795	7,995	15.4	12.6
Others	695	1,580	2.8	2.5
TOTAL	24,600	63,300	100.0	100.0

Area	12/31/46	12/31/55	12/31/46	12/31/55
	Million Dollars		% of Total	
United States	17,700	40,400	72.0	63.8
Canada	425	2,525	1.7	4.0
Venezuela	1,150	3,450	4.7	5.4
Other Western Hemisphere	1,250	2,440	5.1	3.9
Western Europe	1,125	4,060	4.6	6.4
Africa	175	425	0.7	0.7
Middle East	900	2,750	3.6	4.3
Far East	550	1,950	2.2	3.1
Foreign Tankers	1,325	5,300	5.4	8.4
TOTAL	24,600	63,300	100.0	100.0

Participation of American capital in foreign oil enterprises is shown in Table III.

Table III AMERICAN PARTICIPATION IN OPERATIONS LOCATED IN FREE FOREIGN COUNTRIES—YEAR 1955

	American Companies	Others	Combined	American % of Area Total
	Million Dollars			
Gross Investment in Fixed Assets (Year-End)				
Canada	1,365	1,160	2,525	54.1
Venezuela	2,095	1,355	3,450	60.7
Other Western Hemisphere	750	1,690	2,440	30.7
Western Europe	1,045	3,015	4,060	25.7
Africa	100	325	425	23.5
Middle East	1,290	1,460	2,750	46.9
Far East	755	1,195	1,950	38.7
Foreign Tankers	575	4,725	5,300	10.8
TOTAL	7,975	14,925	22,900	34.8
	Thousand Barrels Per Day			
Crude-Oil Production				
Canada	247	108	355	69.6
Venezuela	1,459	699	2,158	67.6
Middle East	1,818	1,432	3,250	55.9
Other Countries	249	984	1,143	21.8
TOTAL	3,773	3,133	6,906	54.6
Crude Runs to Stills				
Canada and Venezuela	649	421	1,070	60.7
Western Europe	534	1,556	2,090	25.6
Middle East and Africa	520	329	849	61.2
Other Countries	751	1,310	2,061	36.4
TOTAL	2,454	3,616	6,070	40.4

GOVERNMENT INCONSISTENCY—

Threat to our international oil position

By Leonard M. Fanning*

Is the United States engaging in economic imperialism when it seeks to impose domestic anti-trust laws on American companies operating in foreign countries?
Should the United States restrict its nationals by a code by which competitors are not bound.

Is it good public policy for the United States Government to repudiate its nationals in the eyes of foreign governments by charging monopolistic acts which are not illegal outside the U.S.?
Do such charges tend to aid Communist propaganda?

Should the United States Government appeal to international companies for aid in crises such as that created by the Suez stoppage when compliance immediately subjects the companies to Senatorial charges detrimental to the public good will of the companies?

WHEN President Eisenhower gave the greenlight to the Middle East Emergency Committee Plan for Europe, Senator O'Mahoney of Wyoming, acting chairman of the Senate Antitrust Subcommittee, said that committee plans "should not favor the large oil companies at the expense of the United States people." He noted that companies represented on the committee were defendants in Government "oil cartel" antitrust and "overcharge" suits.

It seems to me that Senator O'Mahoney's statement, which more than inferentially reflected on the five companies involved in those suits, pointed up the need of doing something about a glaring inconsistency in Government policy. This inconsistency is a most serious one. For it involves not simply the good name of an important segment of the American petroleum industry, but our nation's vital interests and standing in the Middle East and elsewhere in the world.

The Government's Suits

It is true that five of the fifteen companies on the new emergency oil committee have been named in the Government cartel suit and that the same concerns, less one, are defendants in an action alleging overcharging on Marshall Plan sales.

Early in the Presidential election campaign in the summer of 1952, the Senate's Select Committee on Small Business released a report prepared by the staff of the Federal Trade Commission and titled "The International Petroleum Cartel." This report—which was prepared without giving the oil companies a hearing and without the official approval of the Senate Committee or of any governmental body or agency even by the Federal Trade Commission itself—charged that five American companies, Standard of New Jersey, Socony-Vacuum (now Socony Mobil), The Texas Company, Standard of California and Gulf Oil, and two foreign oil companies, Royal Dutch-Shell and Anglo-Iranian Oil (now British Petroleum), constituted a world oil cartel.

Largely as a result of the preparation of the report, during the same period the attorney general began a grand jury investigation of the international oil business to determine whether there had been a violation of the United States antitrust laws. Early in 1953, the grand jury investigation was terminated by the government for reasons of national security and a civil action alleging antitrust law violation was substituted. This action is the cartel case still pending. Meantime a federal court invalidated subpoenas served against the two foreign companies, supporting their claim that the United States had no legal authority over them in the premises.

At the same time that the cartel case was instituted, another Government suit, known as the ECA or MSA cases, was filed against Standard of Jersey, Socony, Texas and Standard of California for allegedly overcharging for Middle East oil which was delivered to buyers in Marshall Plan countries in Europe and in connection with which the Economic Cooperation Administration (later known as the Mutual Security Administration and the Foreign Operations Administration) provided dollar financing. This action, too, is still pending.

The American companies emphatically denied that they belong to a cartel. Those accused of overcharging denied that allegation, declaring that the price controversy was a technical matter which had long been under discussion and negotiation between the Government and the companies.

A Bit of History

Until World War I, the long tradition of American foreign kerosine trade, the epic of the lamps for China, involved American marketers in no great need to find crude oil or to build refineries abroad. The United States had plenty of crude oil and refineries. American participation in foreign oil development was confined to only two countries, Romania and Mexico. Then, sparked by the First World War, Mexico became, in effect, a United States oil rush with British and British-Dutch offering stiff competition. Venezuela picked up where Mexico left off and again Americans were vying with the British and British-Dutch in discovery and development.

After the First World War a shortage scare set off foreign oil development in earnest. The post-war San Remo Agreement between Great Britain and France would have excluded American interests from the Middle East. Alert U. S. oil men warned their Government. Royal Dutch-Shell and Anglo-Persian Oil (later Anglo-Iranian, now British Petroleum) were getting exclusive and favored nation rights in what well might prove to be the most promising oil countries of the world. Britain having virtually sewed up Persia (Iran), now under the San Remo Agreement would —along with France and Holland—take

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over exclusive rights in all the old Turkish Empire.

The State Department protested. As a result in 1928 American companies were given a 23¾% interest in Iraq Petroleum. The department's action opened the Middle East's "closed door" a crack.

But it was what American oil companies did in the Middle East unaided by the State Department that has changed the face of the world oil map. In the 1930s Standard of California and The Texas Company, jointly in Bahrain (through Bahrain Petroleum) and in Saudi Arabia (through Arabian American Oil—Aramco), and Gulf (jointly with British Petroleum) in Kuwait, made their sensational strikes.

World War II vitiated the "Red Line Agreement." That agreement strait-jacketed owners of Iraq Petroleum from operating outside the old Turkish Sultanate. Its end enabled Standard of Jersey and Socony, comprising the American group in Iraq Petroleum, to share, after the war, in Aramco's great expansion and in building Tapline to the Mediterranean.

Huge Expenditures

The five American companies poured millions into exploration and development in the Middle East—in Saudi Arabia, Kuwait and Iraq. For example in Saudi Arabia American companies spent $5 million before they discovered oil in 1938; another $3 million before they marketed the first oil. By the end of 1946 Texaco and Standard of California had invested great amounts in Aramco, Texaco alone to the tune of $62 million. That huge sum notwithstanding, clearly much larger commitments would be required if Saudi Arabian production were to be expanded to help fill greatly mounting world needs.

A listing of some of the investments which were made from 1946 to 1952 strikingly illustrates the extent of the American gamble of the first Aramco owners, Standard Oil of California and The Texas Co. Oil-handling facilities, product pipelines and local marketing facilities required a capital totaling $70 million. Expansion of the refinery at Ras Tanura cost $16 million. The construction of housing, roads and general plant facilities totaled $140 million. For drilling new wells an expenditure of $15 million was necessary. Over and above all these investments was the cost of the Trans-Arabian pipeline, running over a thousand miles from the producing fields in Saudi Arabia to the Mediterranean. Originally estimated to cost $125 million by the end of 1950, when the line was completed, it had doubled in cost. Jersey and Socony put a quarter of a billion of dollars in Aramco and Tapline.

By 1955 Saudi Arabia had absorbed a total investment of more than $500 million in exploration, production and pipeline development and in the provision of housing, health, training and educational facilities.

The latest American penetration of the Middle East was in Iran. It came late in 1954 after that country's costly three-year nationalization fiasco. By it, the first five American oil companies participating in an international consortium—Jersey Standard, Socony, Texaco, Standard of California and Gulf—committed themselves to pay an estimated $80 million each.

Importance of Middle East

To visualize the importance of American participation in Middle Eastern oil one needs only to compare United States with Middle East reserves. In 1930 the American share of world reserves was 58% but only 20% of foreign reserves.

From 20 billion barrels on January 1, 1945, U. S. reserves increased to only 30 billion barrels, on January 1, 1956. On the other hand, the Middle East skyrocketed from 26 billion to over 200 billion barrels, and today accounts for 75 per cent of the world's crude oil reserves.

To visualize, moreover, the major role played by Americans in accomplishing these dramatic Middle East results, one finds U. S. interests controlling about 60% of Middle East reserves today, compared with 40% in 1945 (and probably less than 1% in 1930).

Thus, instead of losing out in world position because of the declining ratio of U. S. reserves to total world reserves, American share of total world reserves has more than held its own—representing today probably 65% against the 58% in 1930.

In addition to this, without question American oil operations in the Middle East have advanced understanding between the West and the East. On the whole, American oil operations abroad have been of a character and on a plane to serve well the Free World in these times of tension.

"Sowing the Petroleum"

The phrase, "Sow the Petroleum," refers to the practice of plowing back petroleum revenue into public works and projects designed to stimulate agriculture and diversification of industry in underdeveloped countries.

In the Middle East, in a relatively few years, revenue from oil investment has brought to a desert people standards of living which normally represent the progress of centuries. Health standards have been transformed.

Water supplies have been created by drilling wells which make it possible for once barren areas to produce more of their own food.

Oil-company employees have been taught not only the skills essential to their jobs at the drilling rigs or refineries, but also the "three R's," typing, bookkeeping, nursing and other subjects. Particularly promising employees have been sent to universities.

Doctors, engineers and teachers do and will continue to come from these programs, and they will enable the countries to press forward with increasing vigor and speed, for such policies have a cumulative benefit.

The evolution of "sowing the petroleum" shows the oil companies as spearheading the movement toward better living in underdeveloped countries. Certainly, an objective view points to them as having introduced the economic, social, medical and educational advancement which justifies an expressed evaluation of their efforts as a private Point Four program.

That the maintenance of a vigorous and prosperous oil business abroad which contributes immeasurably to the raising of living standards has served as a bulwark against the spread of communism cannot be doubted. Furthermore, company policies which are based upon the premise that *what is good for the country is good for the company*, which see to it that nationals are given maximum employment, which require full compliance with local laws and customs, all serve to promote amity among nations.

Post-War Aid to Europe

As a means to meet anticipated high demand and to relieve the drain on American sources, Middle East oil was stipulated to fill Marshall Plan requirements wherever possible. In fact, that there had been developed huge Middle East reserves made it practical for European industry, which had been based primarily on coal, to switch to petroleum. The large American oil companies played an outstanding role in the success of the Marshall Plan.

The Economic Cooperation Administration, which directed the Marshall Plan, recognized that petroleum was one of the key commodities, if not *the* key commodity of the European Recovery Plan. E. Groen, secretary of the Netherlands Government Office of Petroleum, reporting on the petroleum results of the Marshall Plan for ECA before the Third World Petroleum Congress in 1951, said, "Fairly soon after the end of World War II, the American companies made no small contribution, by supplying their traditional share in the market, to the reactivation of the European economy." Financing of refineries in these countries with Marshall Plan money was very much a part of the program.

In addition, Jersey Standard, Socony and Caltex (Standard of California and Texaco), on their own and using their own money, launched extensive refinery-building programs in Europe. To provide the equipment and services available only for United States dollars and, to some extent, to expedite construction schedules the companies made substantial direct dollar investments in anticipation of subsequent dollar dividends. Thus the financing of refinery construction by American companies resulted in huge savings to the countries of dollar outlay and helped to effect swift and direct European recovery.

That these companies did, and could, aid in Europe's post-war recovery stemmed in no small part from their position in the Middle East. Rehabilitation and expansion

of Europe's industries and hence its economic life became increasingly geared to oil—Middle East oil. And not to be overlooked is that the United States, too, can't get along without it. In other words, the potency of American initiative in developing great sources in that area as affecting Free World post-war recovery and continuing prosperity is a simple matter of record.

Emergency Plan of 1951

Few Americans realize that the nationalization and loss of Iranian oil in 1951 presented a serious threat to the Korean War effort, to the defense and rearmament program of the United States and to NATO. In June 1951, the last tanker had been loaded at Abadan. The Free World abruptly had lost 610,000 barrels a day of crude oil and products. Quickly the United States Government countered by forming, through the Petroleum Administration for Defense, the Foreign Petroleum Supply Committee. It drew up a "voluntary agreement relating to the supply of petroleum to friendly foreign nations," and invited nineteen American oil companies engaged in foreign operations to join the committee. Conspicuous among them were the five mentioned large so-called international American concerns.

The committee's plan of action called for increases in crude oil production in 11 countries and for a rise in product manufacturing in 27 nations. Arrangements were made among the participating companies for the purchase, sale, loan or exchange of crude oil and refined products for the most efficient use, without regard to ownership, of terminal and storage facilities, tankers and pipelines and other installations.

By the end of 1951 the committee's efforts had averted any setbacks to rearmament which might have resulted from lack of oil and also had replaced much of Iranian production which Iran's huge Abadan refinery formerly had supplied to Europe and to India, Pakistan, Malaya and West African countries. By July 1952 the Petroleum Administration for Defense had approved schedules of various transactions, involving 19,500,000 barrels of crude oil and 26,500,000 barrels of refined products.

"I am certain, and this I say very deliberately, that the direction of those millions of barrels to points of need plus the effective expansion of free world tanker capacity made possible by rerouting under the plan of action contributed heavily to the salvation of the free world's defenses," Secretary of the Interior Chapman and PAD director, declared.

The Iranian Consortium

After Iran's ruinous experiment with oil nationalization, the Free World could not afford to let that nation go by default to communist Russia. It is no accident that the participants in the Iranian oil agreement of 1954 were called a *consortium* which Webster defines as: "Any business or banking agreement or combination to *assist* another nation." The first five American oil companies participating were Jersey Standard, Socony, Texaco, Standard of California and Gulf.

Today Iran is pointed to as "the calmest country in the troubled Middle East."

Department of Justice Clearance

In all these eventful happenings—the 1928 Iraq oil agreement, the 1951 Oil Emergency Plan, the 1954 Iranian oil agreement and the present Middle East Emergency Committee Plan for Europe—a glaring Government inconsistency is shown. In the national interest, the State Department (latterly with the Interior Department implementation) urged on or invited, American companies into agreements among competitors during world wide emergencies. Naturally, American companies would not, and will not, *voluntarily* join each other or with foreign competitors and thus invite antitrust action. Therefore, in every case, under State Department urging, the Department of Justice has given its consent, although sometimes strictly qualified.

After the Foreign Petroleum Supply Committee's successful 1951 plan for action, the Justice Department, which had consented, turned upon the companies and filed the two suits, although the agreement itself was specifically not involved. As in the case of the launching of the present Middle East Emergency Committee's plan of action, at the time of the Iranian agreement the cartel and price suits had been filed. Notwithstanding, in 1954, the State Department invited the participation of the five companies accused of constituting, along with Anglo-Iranian and Royal Dutch-Shell, themselves members of the consortium, a gigantic cartel in restraint of competitive trade.

The inconsistency of government policy becomes apparent. American companies which were, and are, in a position, when called upon, to render vital services to their country in times of emergency and willingly do so at the call of one department, are under indictment by another department. But the bigger question is that our Government, because of inconsistency, undermines the very objective it is seeking; namely, strategic oil security and needed supplementary supply for our own tremendous requirements.

Damage Done by Suits

For few Americans realize how damaging were the published charges of the court actions against the American oil companies when they were made in 1952. The formal answers to the court made in 1953 by the companies in the cartel case raised questions worth serious study. For instance:

Can the United States government regulate business conditions in the Middle East and infringe on sovereignty through the instrumentality of our antitrust laws?

By insisting that American companies comply with standards to which their foreign competitors are in no way obliged to adhere, American companies will be strait jacketed, put at a disadvantage.

The end might be the forced withdrawal of American business interests.

Attempts by the United States to enforce its antitrust laws abroad can be interpreted as a new form of economic imperialism.

Cast in such a role the United States faces grave perils in the Middle East. Russian communist activity is struggling to fertilize the area for just this. Ouster of American companies could result.

The allegations of antitrust violations are interpreted in the Middle East as official and outright U. S. Government repudiation of its own nationals in the conduct of their business.

The stakes transcend private interests.

As to the "overcharging" suit, a Middle Easterner told me: "To us in the Middle East, it is not only incredible but it is presumptive and untenable in international law, that an American court be asked to rule on the price structure in a way that takes into consideration only the interests of the American consumer. What about Saudi Arabians to whom oil is bread and butter?" He called the suits "one of the biggest blunders in the history of American foreign relations."

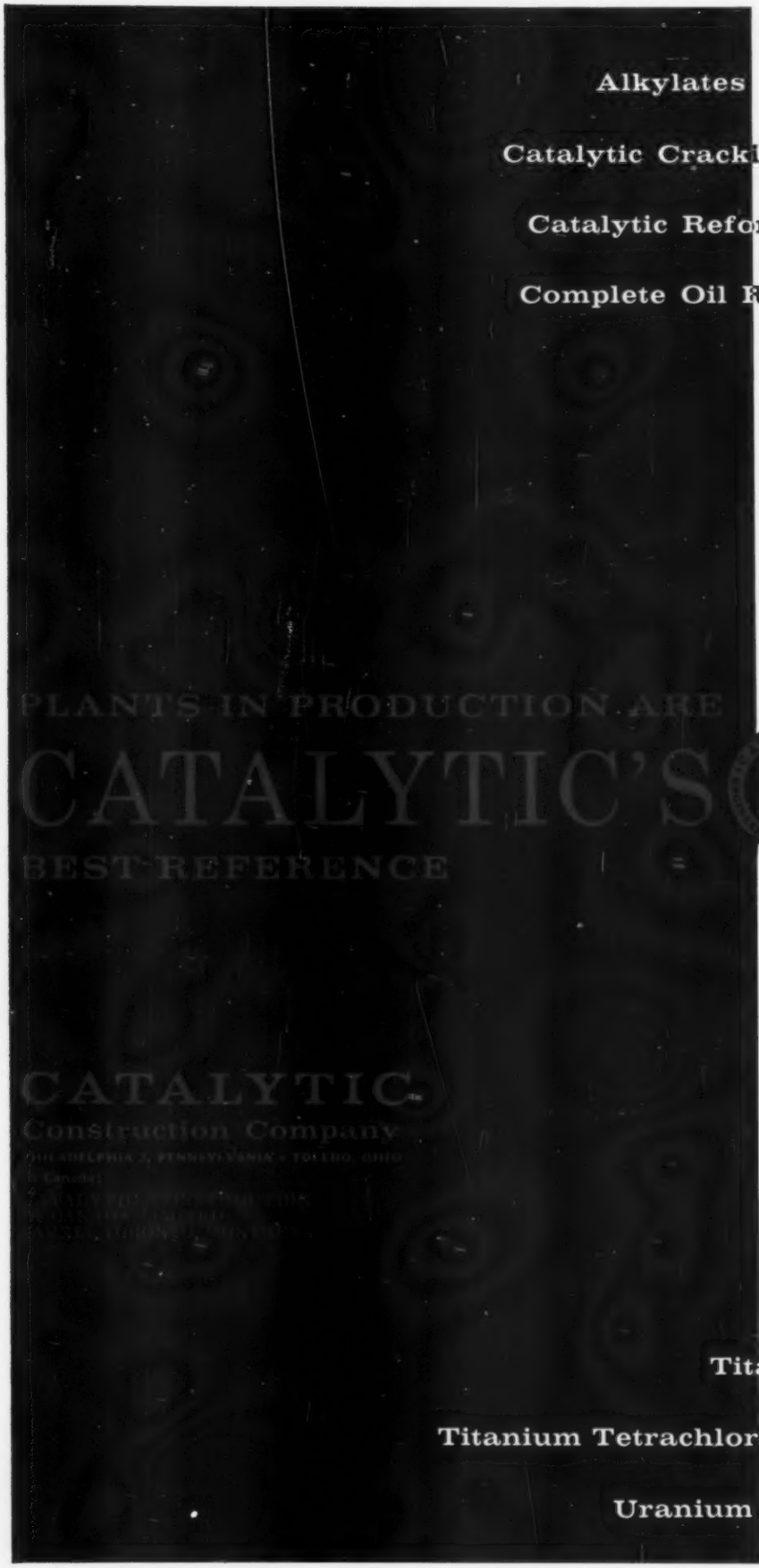
Petroleum's Unique Position

Through the efforts of these companies, the United States has potential access to billions of barrels of oil, to pipelines, tankers, refineries, terminals and marketing facilities abroad, which it would not otherwise have had.

While the suits hang over their heads, the five companies which have done most to secure our world oil position remain vulnerable to attack and innuendo.

Reviewing all the above facts and considering the outstanding achievements of the large American oil companies abroad not only commercially but socially and diplomatically, it is difficult to discern an activity "at the expense of the American people."

Petroleum occupies a unique position in the destinies of our country and the Free World. It seems to me that there is a pressing need to clear up Government inconsistency. The status of American overseas operations should be carefully considered in relation not only to the control of strategic reserves in case of war but also in relation to the contribution these activities make to the prosperity of nations and to the raising of living standards in underdeveloped countries. END



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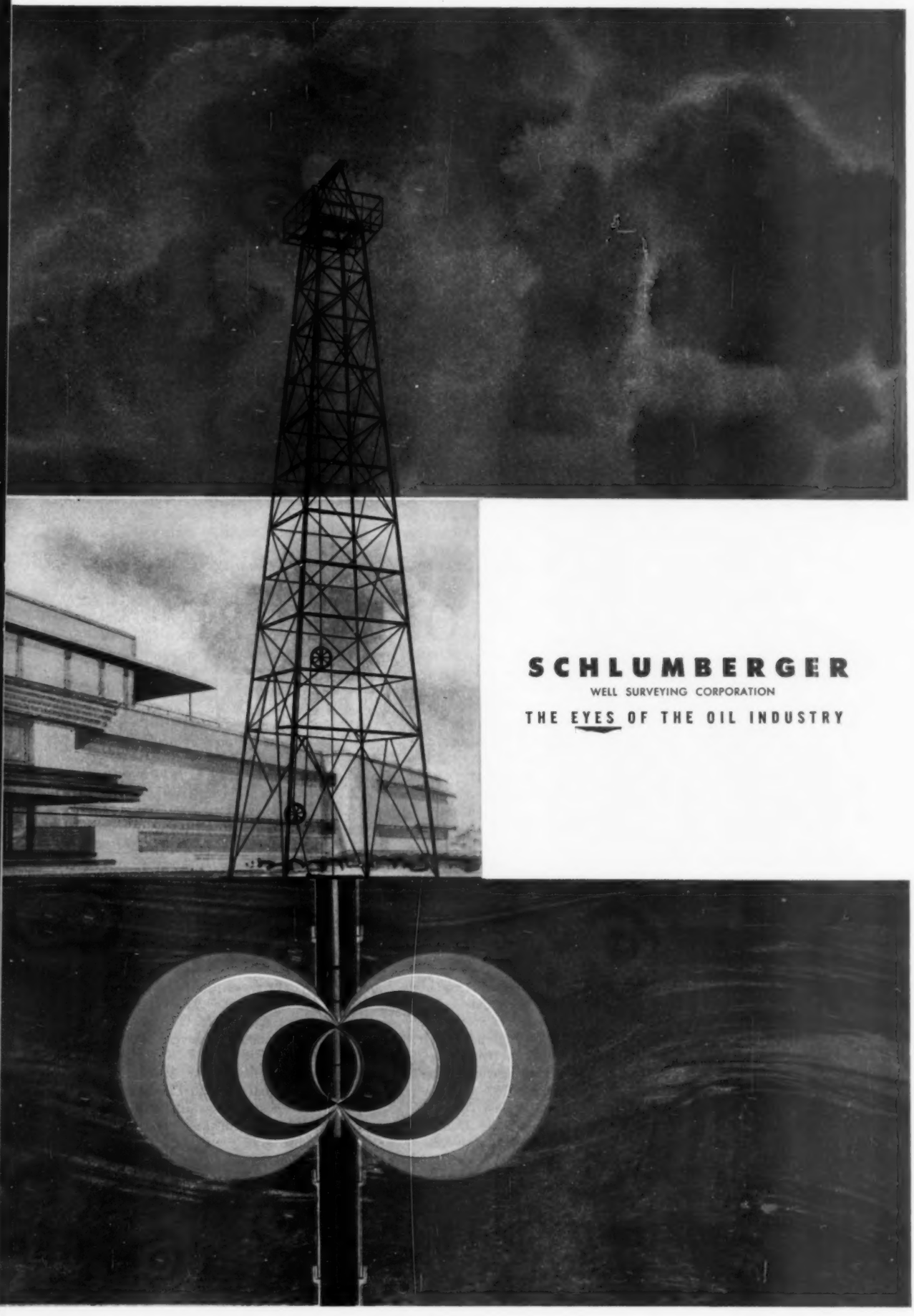
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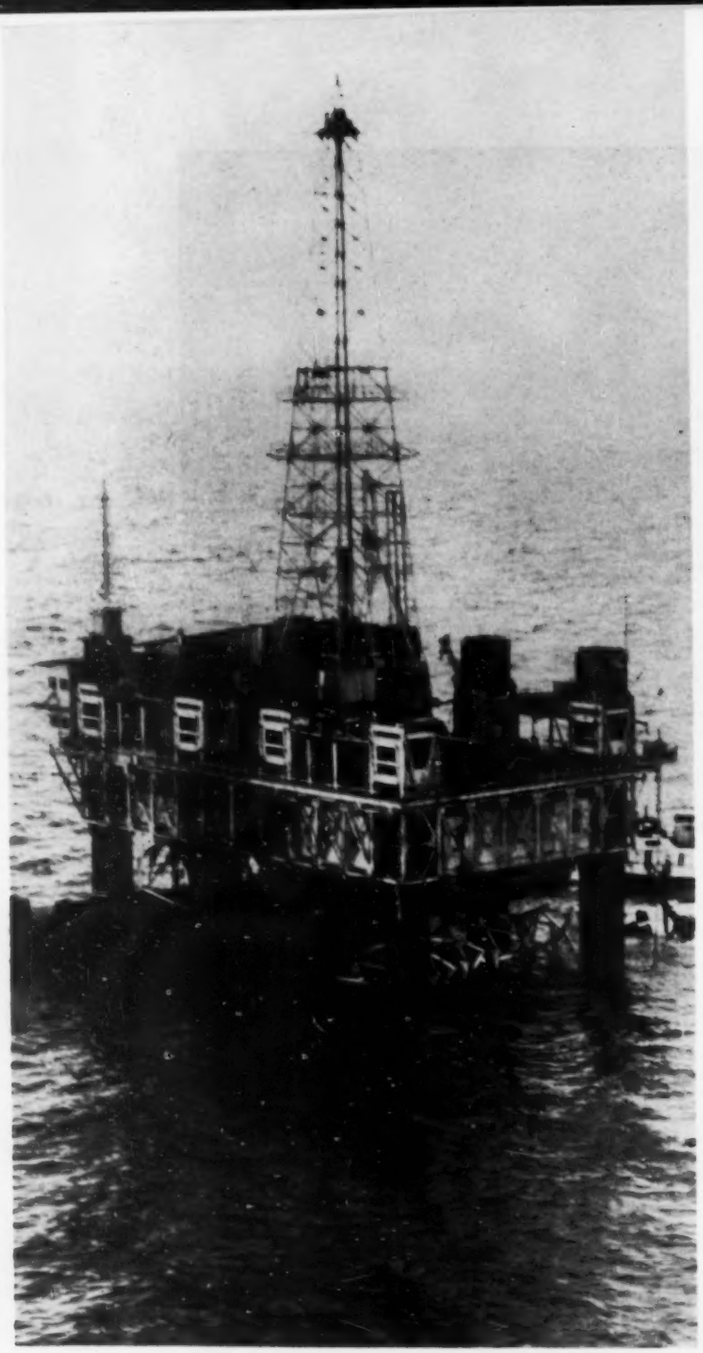


Aerial view of Shell's offshore platform showing one pontoon (in foreground) partially sunk, and the other (in background) still in position, although badly damaged.

OFFSHORE LULL IN PERSIAN GULF

THE outbreak of hostilities at Suez, plus two dry holes and a wrecked Shell rig off the Qatar coast, have brought offshore exploration in the Persian Gulf nearly to a standstill.

In Iran, interest has been shown in offshore areas outside the three-mile limit which is held by the consortium offshore from low-water mark. Among the bidders who have made the trek to Teheran is Christian F. Dohm, president of the Conorada Petroleum Corp. Conorada represents the combined interests of Continental Oil Co., Amerada Petroleum Corp., and The Ohio Oil Co., and, between them, they share extensive knowledge of offshore work, through their operations as part of the CATC group which has been working in the United States tidelands. Other companies which are known to be interested include most of the majors, such as Jersey Standard, Royal Dutch Shell, British Petroleum, Ente Nazionale Idrocarburi (the Italian government's company), and the H. L. Hunt oil interests in Dallas, Texas.

Negotiations for rights off the Iranian coast (as well as onshore) have to be conducted with the government's National Iranian Oil Co., which is known to have some extravagant ideas concerning the possible size of Iranian reserves. For example, it has estimated its total possible reserves at about 500 billion barrels, an amount more than twice as large as estimated proved reserves for the world as a whole at the end of 1956. The recent discovery at Qum did nothing to dispel this idea, and it has made the government difficult to deal with.

Temporarily at least, most Middle East negotiations are halted until the dust settles. The Arab hostility toward British and French actions in the Sinai peninsula, however, undoubtedly has worsened the bargaining position of those countries' companies. British Petroleum Co. was reported to have retained a favorable, if not a preferential, position in Iran for new rights following the consortium negotiations. The new circumstances have undoubtedly changed this.

Part of a capsized 1,800-ton pontoon, part of Shell's offshore drilling platform, is shown after a storm on December 27. Preparations were underway for towing to Doha when a heavy cross-sea separated the supporting 1,800-ton pontoons and severely damaged the main structure and steel legs of the platform.

The consortium, with 17 companies involved, has a good record of operation, and might have the inside track on bidding. While the offshore rights they have now only extend the indicated three miles from low-water mark, they have the offshore rights to the waters surrounding Iranian islands. They reportedly are rigging up for an offshore test at present.

Across the Persian Gulf, offshore concessions are held down to the tip of Muscat and Oman. The farthest south is held by Petroleum Concessions Ltd., a subsidiary of the Iraq Petroleum Co., which is owned 23¾% each by Cie. Française des Pétroles, British Petroleum Co., Royal Dutch-Shell, and Near East Development Corp. (jointly owned by Jersey Standard and Socony Mobil Oil Co.)—with 5% owned by Participations Ltd., the C. S. Gulbenkian estate. No drilling has been done as yet on this 1,200-square-mile area. The next concession, following the Persian Gulf upward, is the Dibai concession which is held jointly by British Petroleum Co. and Cie. Française des Pétroles, with 2/3 interest accruing to BP. No drilling has been done as yet on this 12,000-square-mile area, but an exploratory well is planned this year about 20 miles off the small island of Das, some 60 miles north of the Trucial Coast mainland. A base camp is now being set up on the island; and a drilling barge, purchased in Germany, now is being assembled for work in the area. The estimated cost is about $14 million, and the rig will be capable of drilling a maximum of 15,000 ft in up to 50 ft of water. The company has done extensive geological and geophysical work in the past in the area; during 1956 a survey party on the "Astrid Sven," a passenger-cargo ship, did some work carrying on the 1954 work which divers from the "Calypso" and the Geomarine Service International ship "Sonic" had done.

The most active explorer has been Shell Overseas Exploration Co., which has a 10,000-square-mile marine concession off Qatar, acquired in 1952. Two wells were drilled by the company. The first, Matvakh, was located about 36 miles north-northeast of Doha, the capital of Qatar, and about 5 miles offshore. It was abandoned at 6,700 ft. The second well was at Idd al Shargi, about 45 miles east of Doha. This well went to 12,000 ft with no oil discovery, and it brought the total expenditure on the effort to about $21 million. A third well was planned in the early months of 1957; but Shell's mobile oil-drilling platform, described and illustrated in *World Petroleum*, July 1956, p. 64-7, was wrecked 50 miles off the coast of Qatar in the Persian Gulf. The structure and ancillary equipment are considered a total loss.

One laborer is known to have died, and a number of others are missing, as a result of the accident which occurred during the towing of the platform to Doha for modification. There were no casualties among the European technical personnel.

At about 11:00 pm the wind changed direction, and a heavy sea developed from the northeast across the prevailing northwesterly swell. The two 2,000-ton pontoons on which the platform was being supported for towing broke loose and caused damage to the electricity-generating machinery on the structure, and all the lights were extinguished. The platform legs were damaged, and the helicopter landing stage collapsed—though the helicopter escaped. Soon after midnight it was decided to withdraw all personnel from the platform. One of the pontoons is reported to have sunk subsequently, and further major damage to the platform has been sustained.

The structure was a movable island resting on eight legs which were not pile-driven into the seabed. When being moved, the two 1,000-ton pontoons were lowered and fastened to a steel platform beneath them; the legs were then raised, and then the platform towed away. The company undoubtedly will consider closely the advisability of further work in the area, since initial results were disappointing and the steel shortage will mean that many months will have to transpire before the platform can be put back in operation.

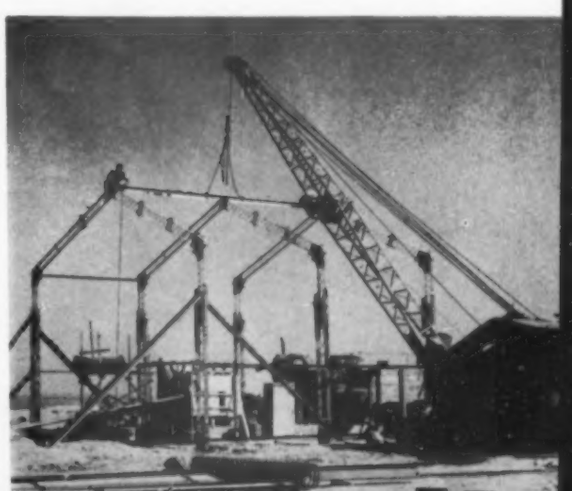
The Persian Gulf is nowhere over 600 ft, a depth which soon may be in the range of feasible drilling. However, at present drilling is limited to about 60 ft, since there are very strong currents, tides, and winds. Only about one-third of Shell's Qatar concession is less than 60 ft deep.

Kuwait, the oil-rich sheikdom at the head of the Persian Gulf, called for bids more than a year ago on offshore areas. The two owners of the Kuwait Oil Co. (which has the offshore rights to a distance of six nautical miles from low-water mark), British Petroleum Co. and Gulf Oil Corp., definitely have indicated they are not interested. A draft concession was passed around to interested companies during 1956. It contained the standard 50-50 principle, and the usual general terms found in Middle Eastern concessions. No action has been taken as yet, partly because the area available for concession is still ill-defined. Generally, the offshore rights of riparian states is considered to extend to the middle of the gulf; but some states, such as Iran, claim islands as far away as Bahrain. Second, the government of Kuwait is said to prefer development by a single entity, which would mean that several would have to form a group to handle the high cost of bonus and other payments combined with exploratory costs.

The procedure on bidding so far has been of an exploratory nature. After calling for bids, it is understood the offers will be canvassed and the three highest asked to compete with one another.

The most successful exploration offshore to date has been by Aramco. The company obtained the offshore rights from Arabia during 1947 and 1948, when it gave back some of the "preferential" area of its concession. It now has the Middle East's only offshore field, Safaniya. This field has a proved area of 69,300 acres, producing 27 API gravity oil from around 5,560 ft. It was discovered in 1951, and at the end of 1956 had about 14 wells. All are shut in pending completion of an under-water pipeline, which should permit production during 1957. Originally it was planned to have crude flowing in the second quarter of this year, but the Middle East unrest may have delayed this. The line being constructed is 140 miles long, 22 in. in diameter, and will go to Ras Tanura refinery.

Large areas remain open in the offshore Middle East. That area offshore from Iraq has not been explored yet; the Neutral Zone is still open outside the three miles offshore held by the two independents, Getty Oil Co. and American Independent Oil Co. (Aminoil). South along the Trucial Coast, below the Petroleum Concession Ltd. area, there are areas open around the peninsula. END



Abu Dhabi Marine Areas Ltd., owned two-thirds by British Petroleum and one-third by Cie. Francaise des Petroles, will drill a deep text off Das Island in the Persian Gulf later this year. This is the habor base camp.

Camels and
CATALYSTS
"When I die, my sons," said the old Arab sheik, "you, Ibrahim, will receive half of my property. You, Abdul, will receive one-third, and little Omar, one-ninth".
When their father died, the brothers were embarrassed to find that the property consisted of seventeen camels. However, a friend of their father helped them to solve the problem by lending them yet another camel, with the result that Ibrahim now owns nine healthy camels, Abdul is very proud of his six, and little Omar cannot decide which of his two he likes the better.
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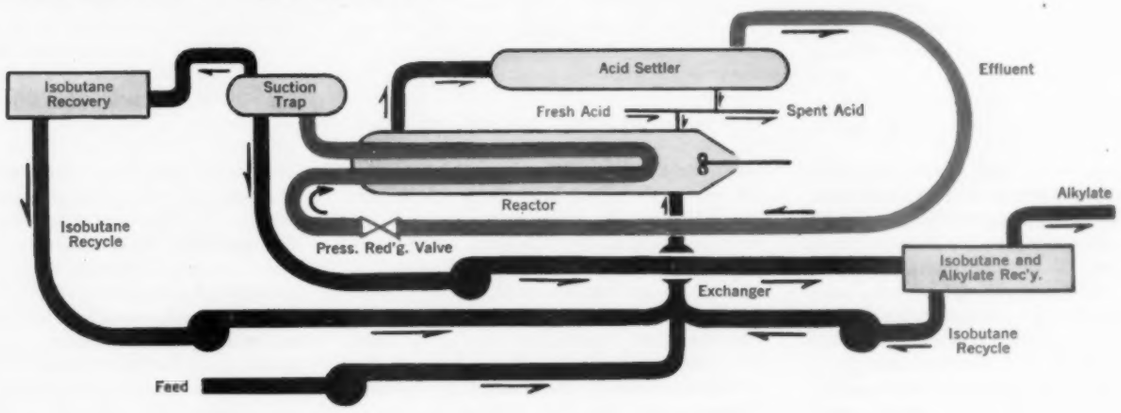

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MIDDLE EAST TRANSPORTATION PUZZLE

THE impact of the Suez Canal nationalization and invasion has shifted fundamentally the balance of power in the Middle East—elevating the prestige of both Russia and the United States and diminishing that of Britain and France. Apart from its home political effects, such as the resignation of Eden and its possible effect on the United States' elections, the new alignment of powers already has brought about a revolutionary change in US policy—referring, of course, to the new Eisenhower doctrine for the Middle East.

This is the basic change which has occurred, but there have been other changes as well. Most noticeable to the oil-producing Arab states is the decline in their income. Oil shipments to Europe have declined to slightly over a million b/d, of which around 330,000 b/d is going by Aramco's pipeline to the Mediterranean and the rest by tanker. This compares with about 2,350,000 b/d normal flow, and it entails a cut in production in the Middle East of 35% to 40%. The result is a decline in income in excess of a million dollars a day—roughly one-third.

Iraq is the most affected, since it now only can export production from the Basrah field—there is no pipeline from the big Kirkuk field to the Persian Gulf. This means a reduction of around three-fourths in income and production. It will damage Iraq's economy and possibly the prestige of Nuri es-Said's pro-western government as well.

Europe's consumption has been reduced by about 17% for a period of several months. There will be a big drain on dollar reserves, and upward pressure on prices and freight rates.

Assuming that the crisis will blow over eventually, even though the effects of increased Russian penetration in the area will remain, the old problem of getting the oil to market and meeting demand increases of the world is still with us. The first and most vital job, of course, is to clear the canal and repair the pipelines as soon as possible.

United Nations salvage teams under General Wheeler have at last begun clearing the Suez Canal of sunken ships, continuing work previously carried out by salvage vessels of the United Kingdom and France, whose operations ceased when British and French troops left Port Said.

Three salvage teams are on this operation, i.e., from Port Said to El Fordan, from El Fordan to Lake Timsah, and from Lake Timsah to Suez. It is estimated, by General Wheeler, that the first part of the operation, i.e., clearing a channel for vessels of up to 25-ft draft, will be completed by early March and that vessels of maximum draft of 34 ft 6 in. would be able to pass through the canal by May.

These dates seem to be somewhat optimistic; but, if they can be met and the channel cleared—which is at least 185 ft wide—then any of the modern tankers could pass southward through the canal under ballast. This would shorten the round journey from the Persian Gulf to European ports by about 20%, since it is estimated that a tanker going round the cape both ways can only carry 60% of the cargo it would carry making the voyage both ways by the canal; whereas going in ballast through the canal this would be raised to 80%.

If General Wheeler's estimates are not too optimistic, it is possible that supplies of ME crude to Europe can be increased materially by May.

Sabotage of Iraq Petroleum Co. pipelines by Syrian soldiers, at the end of October, put a stop to export of crude from Kirkuk and Mosul fields. Extent of this sabotage is not known, since Syria has withheld entry permission for IPC. Responsibility for the damage has been assumed by Syria; so there are faint hopes that the start of these repairs will not be too long delayed. If engineers and technicians of IPC can get on with the job—with free access, unhampered in their work, and with adequate protection—it would only be a matter of weeks before a partial flow of oil to the ports could be started. However, since the extent of the damage to the pumphouses is not yet known, no estimate of the time required for full operation can be made.

Assuming full transit through the canal is restored, along with IPC's lines to the Mediterranean, consideration again can be undertaken of the future transportation problems in the Middle East, which is being pushed at a tremendous rate by the growing consumption needs of Europe, the world's largest crude importing market.

Under any ordinary circumstances, tankers are the safer mode of transport from a political point of view, especially where pipelines are forced to cross the territory of other nations, as are the Middle East lines to the Mediterranean.

On the other hand, logistics—from the point of view of steel supply and expense—greatly favor pipelines. Modern pipelines, with cathodic protection, have a very long life; and maintenance costs for the line itself are not unduly high, nor are those of pumping equipment. There is a full-time one-way flow of crude oil which, except in case of a breakdown, can be continued for 365 days of the year, 24 hours a day; and, provided standby tankage is available at either end of the lines, there should be no delay—except from weather causes—in the loading of tankers at the discharge end of the pipeline.

Compared with the tanker of 30,000 dwt, with a speed of 14 knots, there is a saving of steel in building a pipeline such as that of an organization like Tapline, Aramco's company operating the huge pipeline to the Mediterranean from Saudi Arabia.

It is generally agreed by the main tanker companies that an average modern tanker can make seven or eight roundtrips per year between Persian Gulf ports and western European ports, and that a similar tanker running between the Mediterranean oil ports and the same destination can make 14 to 15 roundtrips per year. These figures allow for off-time for repairs and main-

tenance. Although Tapline is handling about 320,000 b/d, it safely can be assumed that, with increased pumping facilities, this figure could be raised to 500,000 b/d—which figure would apply to a new line of similar size if it were built.

A duplication of this line, with an outlet at a selected point on the Mediterranean, would be quite possible. Tapline is 1,068 miles long, and a duplication of it would mean the provision of some 302,000 tons of steel—including pumps, pumphouses, etc.

The 30-in. to 32-in. line of Iraq Petroleum Co. from Kirkuk to Bahrain, which is 550 miles long and was completed in 1952, cost $114.8 million. It is estimated, however, that a duplicate of this line, owing to increased labor rates and prices of materials, would cost about 40% more, i.e., about $162.4 million. As conditions for building a line to the Mediterranean seaboard are similar to those obtaining in Iraq, it is a fair assumption the cost per mile for a similar-sized pipeline would be about the same—making a total, say, of $456 million.

If one takes the minimum figures for voyages per year from Persian Gulf and Mediterranean ports to western European ports of the average modern tanker, it will be seen that only half the number of tankers of equal size and speed will be required to transport oil to European ports for the Mediterranean service against the Persian Gulf service. A 30,000 dwt tanker working from the Mediterranean ports, and making 14 complete voyages per year, would transport about 420,000 tons (3 million barrels) of crude and, therefore, to handle to throughput of a new line, some sixty 30,000 dwt tankers would be required; but, if the crude had to be hauled from the Persian Gulf, this number would be doubled.

Present costs of 30,000 dwt tankers run at about £80 ($224) per deadweight ton or $6.7 million per ship; so the 60 tankers mentioned, at present costs, would run to about $402 million, as against the cost of $456 million for a pipeline of the same capacity. The steel required for the building of 60 tankers of this capacity would be about 500,000 tons.

The provision of this extra number of tankers also would tax to the utmost the building capacity of world's shipyards—the deadweight capacity of the world's tanker fleet, over the past 7 years, having increased at a net rate of about 2.4 million tons per annum (this includes deduction from the building capacity of tankers which have been lost at sea, transported to other services, or broken up).

Therefore, it would appear that from the point of view of capital expense and also consumption of steel—which is not in overabundant supply at present—the building of trans-Arabian pipelines to avoid the passage through the canal has many points in its favor—provided, always, that the political conditions in the relevant Arab countries remain stable, and that appetites for undue income increases do not get out of hand.

Another side of the picture is that of the canal itself. Assuming that some compromise will be arrived at to solve the present difficulties, and that in the future the canal will function to full capacity; further, that the improvements which already had been budgeted for by the Suez Canal Co. will be carried out, an estimate can be made of the canal's capacity.

The improvements include deepening and widening of the channel so that vessels of deeper draft can pass through. At present the standard maximum draft for vessels is 34 ft 6 in.; but, in the case of certain vessels, a certificate to enable them to load down to 35-ft draft can be obtained. When the projected improvements have been completed, it is expected the maximum size of tankers which can pass through the canal fully loaded will be 40,000 dwt, and at least one of the major tanker owners is budgeting on that figure.

This would rule out the passage of some of the new mammoth fast tankers through the canal with a full cargo, but probably would not rule out their passage south in ballast; so the outward voyage could be made via the cape, fully loaded, and the return one as above.

Some 67 million tons of crude oil and petroleum products passed northwards through the canal in 1955, and possibly a larger amount could have been handled if required. It has been estimated that the capacity of the Suez Canal for northward transport of petroleum, after completion (if ever) of the program of improvements—which the old company had in hand—will be about 160 million to 170 million tons per annum (3,200,000 b/d to 3,400,000 b/d). Any increase in excess of this amount would require the cutting of a further canal, plus a large increase in the pipeline capacity across Arabia, or the provision of large speedy tankers traveling round the cape, or a combination of all three methods.

The mammoth fast tanker carrying crude oil via the cape to the USA and European ports has much to recommend it from a long-term standpoint. The time taken for building, say, a 100,000 dwt tanker is not much longer than that for building a vessel half the size. The same berth will serve; the steel required for the larger vessel would not be twice the amount required for the smaller one; nor would the crew required for running the vessel be double. On the other hand, there are relatively few yards which have the accommodation for the building and launching of these very large tankers, and drydocks capable of taking them in for overhaul and repairs are fewer still. However, this is not an insoluble difficulty; and there is little doubt that, if a number of these large tankers are required, the necessary facilities will be provided as a natural business measure. Recently several shipyards, both in the UK and on the continent, have announced they are preparing berths for the building of these mammoth tankers up to 100,000 dwt.

This question of supertankers has various possibilities, apart from the actual building of them and putting them into commission. The majority of them have a speed of at least 15 knots; in fact, the "Spyros Niarchos," on its latest voyage from the Persian Gulf to the south of France, averaged 17.34 knots for the whole voyage. This increase of 2.34 knots over 15 knots means that such a tanker could make one more voyage per year to European ports, from the Persian Gulf around the cape, than the 15-knot tanker—thus increasing its annual capacity. The carrying capacity of the world's tanker fleet, therefore, depends on speed as well as size.

By 1965 Middle East demand is estimated to rise to 6.2 million barrels per day and, by 1975, to 13.2 million—almost as much as the total world consumption in 1955.

With modern scientific reservoir working, it can be taken as axiomatic that a field will not be overproduced, and also that the annual production of a company is a compromise between the working of its fields and demand for its crude; and that one aspect affects the other. Also, in the main, it can be stated that, if increased production—within reason—were required by any one company in the Middle East, it would only be a question of lack of handling facilities which would prevent this increase, and not lack of oil. It follows, then, that in future years, as demand increases, this will entail increased handling facilities.

The Iraq Petroleum Co. and its associates have announced that, prior to the commencement of the canal crisis, they had inaugurated a survey for a pipeline to run only through Iraq and Turkish territory; this preliminary survey now has been completed, and it shows that, from a technical standpoint, such a line is quite feasible. Suggestions have also been made regarding a pipeline from Kuwait through Iraq to a Black Sea or Mediterranean port, but no confirmation of this can be obtained. It would appear that the most feasible project, and one easiest of carrying out, would be a duplication of Tapline.

The cutting of a new canal from the top of the Gulf of Akaba to the Mediterranean has been proposed; but, to avoid Egypt, that would mean passing through Israel, if the shortest route is to be taken, and the approach to the inlet would be commanded on one side by Saudi Arabia and on the other by Egypt—which countries are not exactly friendly to Israel.

Still another suggestion has come from Aristotle Onassis, one of the largest independent tanker owners. He has suggested pipelines paralleling the Suez Canal, which could unload large tankers to go through the canal and reload at the other end. At present large tankers may unload at Aden and pass through the canal to reload at the Mediterranean terminals on the other side. It remains to be seen whether the pipeline idea is feasible.

Still another idea, advanced by Captain Harry Russel, a tankerman with many years of experience in the area, is construction of shallow-draft powered barges of about 50,000-bbl capacity. These could unload the ship and follow her through to reload at the other end. END

Part I

THE ROLE OF PETROCHEMICALS IN SURFACE COATINGS

*by Peter W. Sherwood**

Petroleum-derived chemicals play a significant part in the formulation of modern surface coatings which now has become an industry with sales totaling $700 million annually.

IN 1956 manufacture of surface coatings (paints, varnishes, lacquers) consumed some 6 billion pounds of chemical products with a combined worth of $700 million. Roughly one-half of this expenditure goes to chemical products which are, at least in large part, derived from petroleum sources.

Following is the consumption pattern in 1956, as estimated by Burrell.[1]

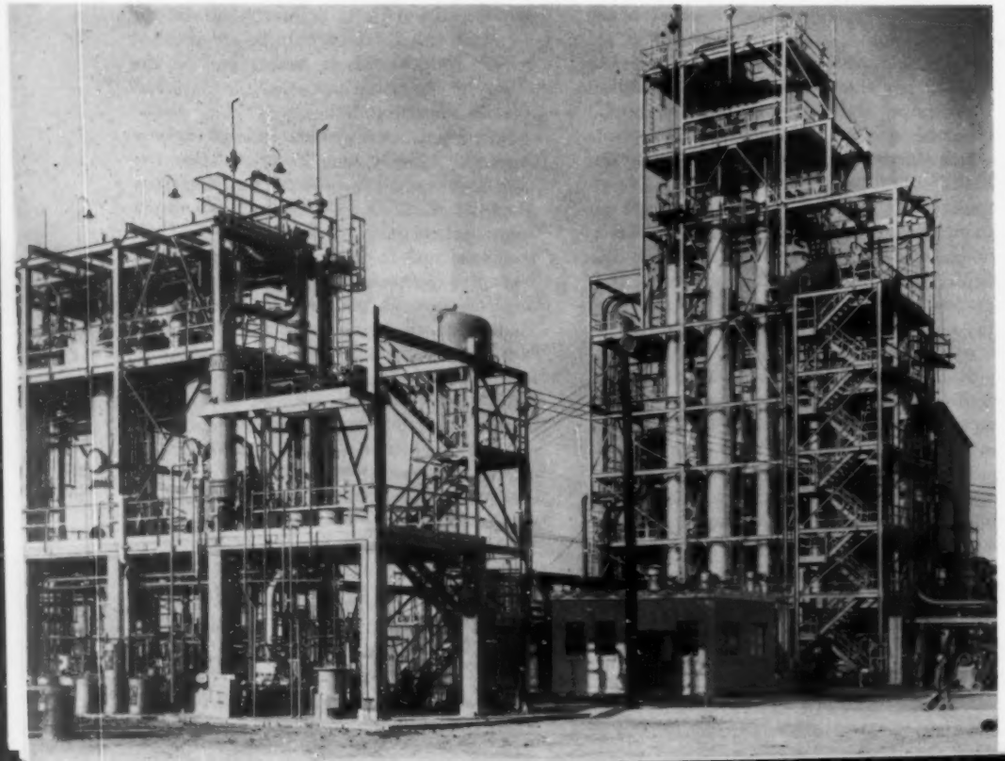
TABLE I

Raw-Materials Class	*Consumption in Surface Coatings* (Millions)
Resins	$220
Solvents and plasticizers	102
Chemicals	44
Additives	18
Oils and fatty acids	95
Colors	221
	$700

In Table I the categories appear in order of their importance as customers of the petrochemical industries. Thus, resins in surface coatings consume pythalic anhydride, glycerol, phenol, formaldehyde, etc., intermediates which are derived from petroleum hydrocarbons in rapidly increasing measure.

At the other end of the scale, colors—primarily inorganic pigments such as zinc oxides and titanium oxide plus organic lakes and toners—are mostly outside the realm of petrochemicals. Also, oils and fatty acids of interest for paint and varnish formulation are derived almost entirely from animal and vegetable sources. This class includes linseed oil, tung oil, soy oil, dehydrated castor oil, fish oil, etc. (listed in order of their dollar sales).

Fig. 2 Vinyl-Acetate Production Facilities at Calvert City, Ky. (Courtesy Air Reduction Co.)



In considering the surface-coatings industry as a market for petrochemical products, our attention, therefore, is concentrated above all on the categories: resins, solvents and plasticizers, and chemicals.

RESINS: the largest of these groups serves as the film-forming base in surface coatings. Various natural resins have been employed for centuries, but their use has been largely curtailed since the introduction of synthetic resins in the late 20's. This development, more than any other, has given to surface coatings the versatility which is called for by the wide range of their applications.

Today, synthetic resins make up all but 7% by weight of the industry's total resin consumption. In dollar volume, synthetic resins constitute 90% of the total. Their sales have experienced steady increases since 1937. By 1944, a 300-million-pound level had been reached, and 1956 consumption is reported at 800 million pounds, worth $220 million. This portion of the market is distributed according to the pattern in Table II.

TABLE II

1956 Distribution of Resins in Surface Coatings

	% of Dollar Volume
Alkyds	41
Phenolics	11
Epoxies	10
Styrene-butadiene	9
Ureas and melamines	8
Vinyls	6
Other	15

Alkyd resins are the front runner by any standard and, among them, the phthalic alkyds are in leading position. This latter group, which makes up 50% by weight of all the resins in coatings, is based on phthalic anhydride plus polyhydric alcohols—notably glycerol, pentaerythritol, and sorbitol. Only 4% by weight of total resin consumption by surface coatings is the share of non-phthalic alkyds. These are based principally on maleic anhydride. In addition, some

*Chemical engineer, White Plains, N. Y.

headway is being made in introducing alkyds based on isophthalic acid, which is readily available to petrochemical producers of phthalic anhydride and terephthalic acid.

Phenolic resins are still in second position, but their importance to the surface-coatings industry is definitely on the decline. They are obtained by reaction of phenol (and its alkylated derivatives, especially p-tertiary butyl phenol, p-amyl phenol, p-phenyl phenol) with aldehydes—among them primarily formaldehyde. As is the case for the bulk of alkyd resins, raw materials for phenolics are definitely within the realm of the petrochemical industries.

Epoxies are the big "comers" of the industry. Commercially introduced in the 1950's, this group of resins is finding rapidly growing acceptance because it permits formulation of coatings with excellent wear and chemical resistance. Despite their drawback of high unit cost, epoxies have pushed into third position among resins for coatings, and there is little doubt that they will surpass phenolics within a year or so. These materials are produced from two petrochemical sources: epichlorohydrin—which may be obtained as an intermediate product by modification of the synthetic glycerin process practiced by Shell (at Deer Park, Texas) and Dow (Freeport)—and bisphenol-A, a condensation product of phenol and acetone.

Next in importance are the styrene-butadiene resins which have come to the fore during the past decade for the formulation of water-based paints. The dollar volume of this group is reported at 9% of all resins in coatings; but, on a weight basis, they make up about 12%—thus indicating the low price of styrene-butadiene resins. Despite this advantage, little future growth is expected in this group. Should there be an unexpected significant growth of water-base paints, much of it will undoubtedly use resins other than styrene-butadiene. The chief competitors are acrylics (for higher quality) and polyvinyl acetate (for lower price). All raw materials in this category are derived from petroleum hydrocarbons.

Ureas and melamines are condensation products of formaldehyde (or, to a much lesser extent, acetaldehyde) with urea or with melamine. As an ammonia derivative, urea is, of course, directly traceable to natural gas which serves as raw material for more than 90% of all ammonia produced in the USA. The other raw material for the urea and melamine resins—formaldehyde—is obtained in part by direct oxidation of butane (plus some propane), but mostly from methanol, a commodity derived to the extent of about 90% from natural gas. Genally speaking, the urea and melamine resins show little promise of important expansion in the field of surface coatings—just as their use in production of plastics has been stagnant for some years.

Vinyl resins in surface coatings are, above all, polyvinyl chloride and PVC-polyvinyl acetate formulations. These resins have attained a consumption of about 27 million to 30 million pounds per year in surface coatings, primarily as solution resins where good corrosion and chemical resistance are controlling factors. Burrell[1] points out, however, that vinyl-resin formulations are limited in usefulness because of low solids and poor adhesion. Consumption of vinyl resins in coatings has been given an opportunity for some increase by the development of formulations using them as organosol resins (for auto finishes, durable goods) and as plastisol resins (for pipe linings, etc.)

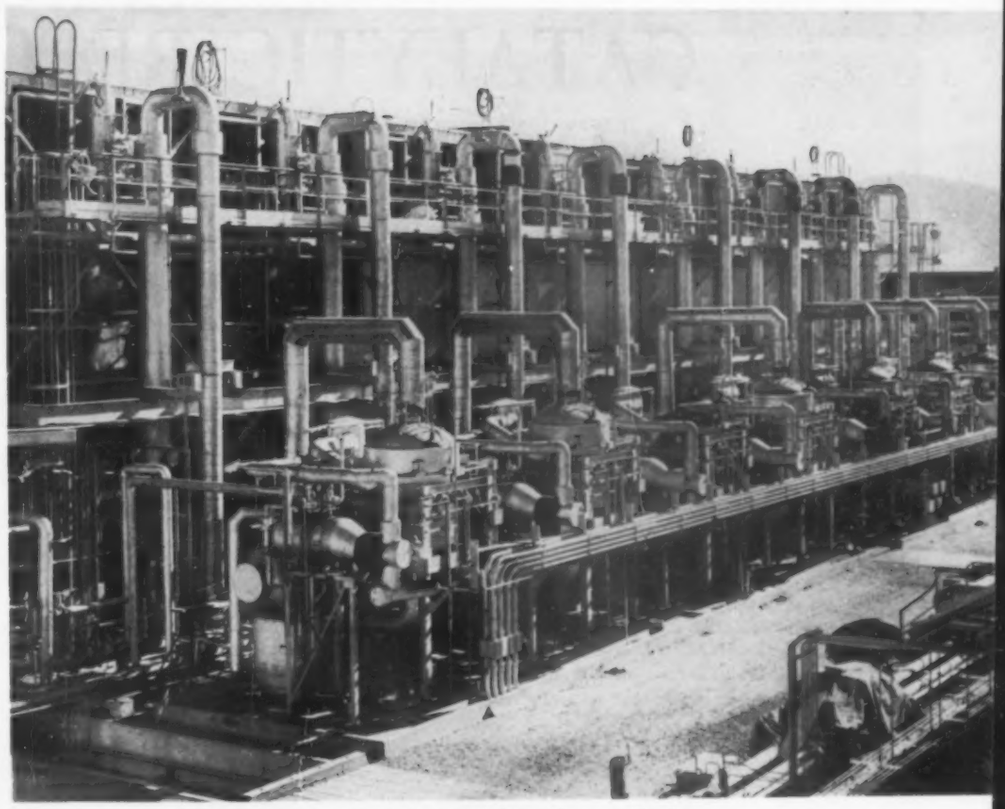


Fig. 1 View of Oronite Chemical Co.'s Phthalic Anhydride Plant (Courtesy Oronite)

"Other" resins, the catch-all category, includes natural resins (such as rosin modifications, shellac, damar, etc.) and cellulosics. The only petrochemical products of any significance within this group are the acrylics which permit the formulation of high-quality water-base paints. Their main drawback is high unit cost.

SOLVENTS AND PLASTICIZERS, the second largest category of organic chemicals in the surface-coatings industry, serve to dissolve the film-forming resins, disperse the pigment, and lower the viscosity of the system for ease of spreading. Materials in this category are now predominantly obtained from the petroleum industry.

The heavy emphasis is on the word "solvents," since plasticizers make up only a small share of the market. Solvents and thinners, on the other hand, are consumed to the extent of about two billion pounds per year. Total annual value of solvents and plasticizers sales for coatings formulations is estimated at slightly in excess of $100 million. An estimated breakdown is shown in Table III.

TABLE III

1956 Distribution of Solvents and Plasticizers in Surface Coatings

	% of Dollar Value
Aliphatic hydrocarbons	25
Aromatic hydrocarbons	28
Alcohols	16
Ketones	16
Esters	9
Terpenes	1
Other solvents	1
Plasticizers	4

The aliphatic hydrocarbons (notably petroleum naphtha) long have been the near-exclusive preserve of the petroleum industry. Since World War II, essentially the same statement can be made about the line of aromatic hydrocarbon solvents—which consist in the main of toluene, xylene, and aromatic solvent naphtha.

Among alcohols, the most important ones for coatings purposes are ethanol, isopropanol, and n-butanol. The ketones used in this field include acetone, methyl isobutyl ketone, diacetone, methyl ethyl ketone, mesityl oxide, isophorone, cyclohexanone, etc. Among esters, we find above all the lower aliphatic acetates. All of these materials are traceable, eventually, to petroleum sources. These oxygenated solvents normally are used in various combination and in admixture with the hydrocarbon solvents or thinners previously mentioned.

The surface-coatings industry consumes only a small share of the total output of *plasticizers*, most of which enter plastics formulations. These are essentially solvents of such high boiling point that they influence the characteristics not only of the solution,

(Continued on page 66)

CATALYTIC REFORMING AND DEHYDROGENATION

A review of Recent United States Patents

By

Heinz Heinemann and Harold Shalit

ALTHOUGH this subject has been reviewed quite recently (World Petroleum, Mid-year issue 1956), an unusually large number of newly issued patents requires that it be brought up to date. The current review covers 53 patents from the group which issued between May 1 and November 1, 1956 and is indicative of the growth of catalytic reforming to the second largest catalytic process in the Industry. Major subjects emphasized in this period are: methods of applying the fluidized solids technique to reforming, and preparation and regeneration of reforming catalysts.

Feed Preparation

The deleterious effect of non-hydrocarbon constituents in petroleum naphthas on platinum type catalysts has been recognized and an increasing number of patents deals with means of purifying naphtha reformer feeds and pretreating catalysts. D. D. MacLaren in Esso Research & Engineering Co.'s patent 2,760,905 describes a process and operating conditions for desulfurizing reformer feed stocks by hydrogenation. Both, nitrogen and sulfur compounds are removed from naphthas according to C. H. Watkin's 2,767,121 (to Universal Oil Products Co.). The naphthas are hydrotreated and then fractionated to separate gaseous hydrogensulfide, ammonia and hydrogen from liquid hydrocarbons. In another U.O.P. patent (2,766,178), W. W. Johnstone removes basic nitrogen compounds from reformer feeds by contacting the oil with a water treated, sulfonated phenon-formaldehyde resin. E. R. Fenske and C. G. Gerhold (2,766,179 to Universal Oil Products Co.) utilize a single hydrogen stream for both pretreating and reforming. Steps are taken to remove oxygen, sulfur and their compounds from the recycle gas after the pretreating stage.

Catalyst Preparation

A technique for preparing an alumina base for reforming catalysts is disclosed in Esso Research & Engineering Co.'s 2,762,782 (C. N. Kimberlin, Jr. and E. M. Gladrow). The alumina has a relatively high surface area and pore volume and high resistance to fragmentation, when employed in a fluidized bed. It also has a very small proportion of pores of less than 60° Å diameter. This base is prepared by reacting metallic aluminum with amyl alcohol in a substantially anhydrous medium. The aluminum alcoholate is treated with CO_2 and hydrolysis is then effected by addition of water. The alumina is dried and heat activated.

The manufacture of molybdena-alumina and chromia-alumina catalysts is the subject of several patents. V. J. Anhorn, M. M. Stewart, and W. E. Morrow (2,758,958 to Gulf Res. & Dev. Co.) nitride a molybdena-alumina catalyst with ammonia at 900-1000°F for 1-5 hours. They claim that this catalyst gives higher octane numbers and better yield-octane relationships in the hydroforming of naphthas. E. C. Attane, G. W. Hendricks and H. C. Huffman (2,760,-907 to Union Oil Co. of California) prepare an improved supported molybdena catalyst by incorporating halogen, such as fluorine or chlorine into the carrier, either before or after deposition of the molybdenum oxide, in such a manner that the halogen is mostly or wholly retained by the carrier. In another Union Oil Co. of California patent (2,748,-062) T. F. Doumani discloses a catalyst consisting of an intimate mixture of: (1) a major proportion of alumina or silica-alumina gel; (2) 4-30% molybdenum oxide or sulfide; (3) 0.5-20% of a sulfate of cobalt, nickel, copper, iron or zinc; (4) between 0 and 5% of impregnated fluorine or chlorine. The reforming catalyst described in Socony-Mobil Oil Co.'s 2,757,145 (W. A. Stover) consists of co-gelled chromia (25-50%), alumina (30-60%) and silica (1-5%), impregnated with a critical minor proportion of molybdena (5-15%). The accompanying graph shows the improved yield-octane relation claimed for this catalyst over molybdena-alumina or chromia-alumina catalysts.

Other patents deal with platinum-alumina catalysts. An alumina gel containing catalyst is described in American Cyanamid Co.'s 2,768,125 (K. D. Ashley, W. B. Innes and T. J. Malley). It is prepared by precipitating aluminum hydroxide gel from an alkali metal aluminate solution by reacting it with a mineral acid, filtering and washing the gel. The filter cake is treated with 0.1-1 mol of either hydrochloric or nitric acid per mol of alumina to form a paste into which 2-30% of an oxide of a polyvalent metal of groups VI or VIII is incorporated. E. A. Hunter and C. N. Kimberlin, Jr. in 2,746,937 (to Esso Res. & Eng. Co.) prepare an alumina sol from aluminum alkoxide and mix it with a platinum or palladium solution to which enough halogen compound is added to provide 0.1-4 wt.% halogen in the final catalyst composition. The platinum or palladium compound is converted to metal either by treatment with hydrogen sulfide and subsequent reduction, or, in the event that the metal compound is readily decomposable by heating, by merely heating the mixture. The method of drying a reforming catalyst is important according to V. Haensel and J. W. Ziglar (2,759,897 to Universal Oil Products Co.). The catalyst is prepared by commingling a solution of a platinum compound with alumina. The composite is dried at 700-1100°F in air containing 0.01578 pounds of water per pound of dry air. E. F. Schwarzenbeck (2,760,912 to M. W. Kellogg Co.) obtains a reforming catalyst by depositing a metallic residue of platinum or palladium on a carrier, using a promoting agent selected from the group consisting of an alcohol and a ketone which has a water solubility of at least 0.05% by wt. at 70°F.

A number of patents are concerned with the acidic properties of platinum reforming catalysts. K. Nozaki and O. Johnson (2,762,-781 to Shell Dev. Co.) have found that the combination of aluminum borofluoride with aluminum fluoride imparts a particularly high activity to catalysts. In Houdry Process Corporation's 2,751,333, H. Heinemann describes the catalytic reforming of gasoline over a noble metal catalyst supported on an acid treated alumina, which has been impregnated with a minor amount of boria (0.1-5% B_2O_3). V. Haensel (2,763,623 to Universal Oil Products Co.) discloses a platinum on silica-alumina catalyst. Silica-alumina cracking catalyst is deactivated by treatment with steam at 900-1800°F to less than 50% of its initial activity, prior to compositing with platinum. A joint patent of The Atlantic Refining Co. and W. R. Grace Co. (2,750,329, W. I. Barrett and C. S.

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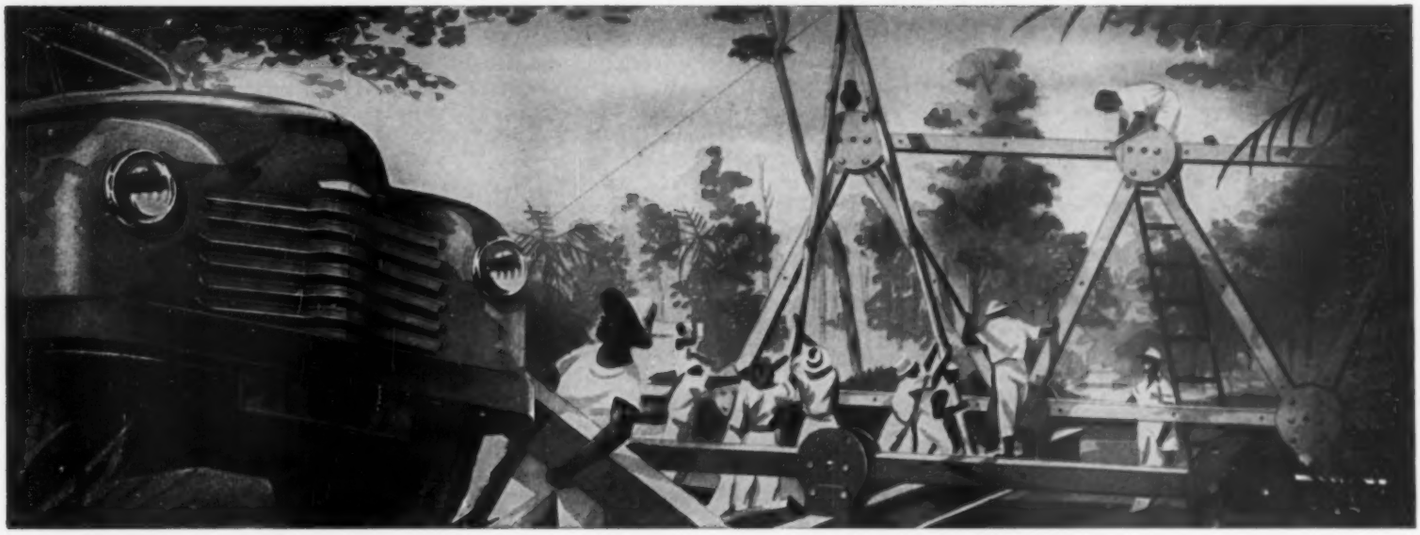

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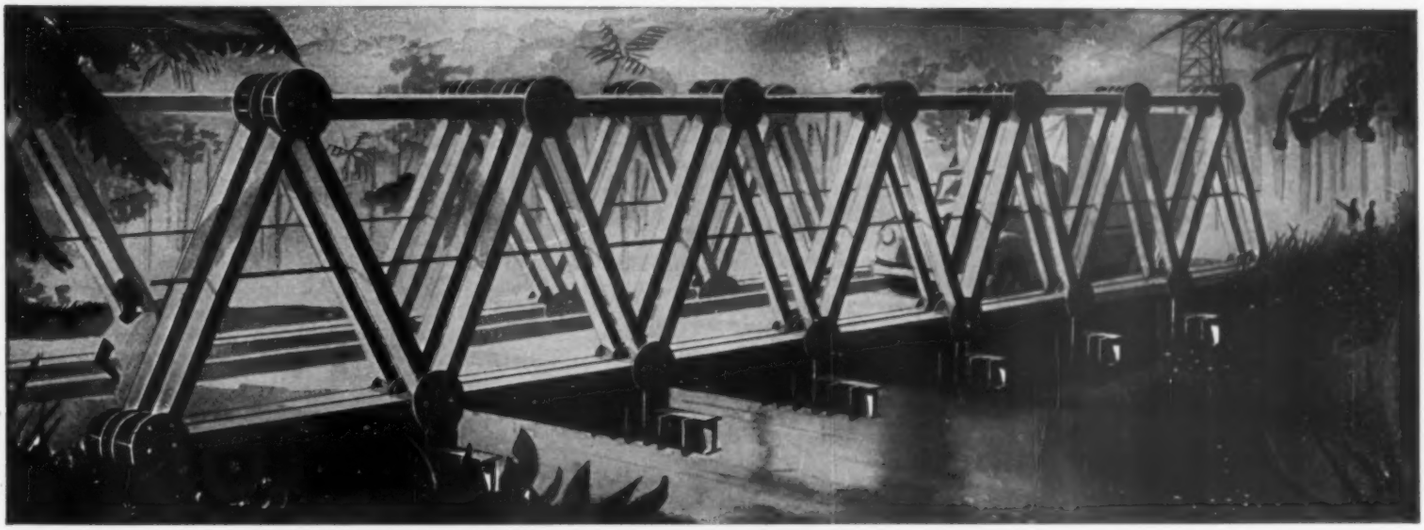

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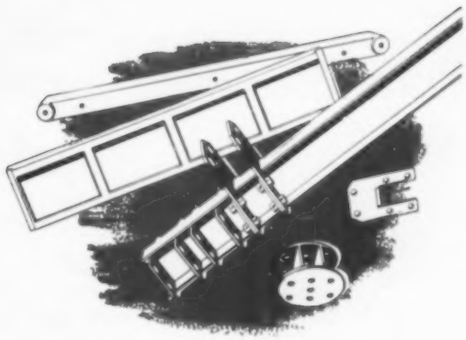

THE BUTTERLEY STANDARD-UNIT BRIDGE

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Shipley) discloses a method of depositing platinum on a silica-alumina cracking catalyst of reduced activity. The catalyst is impregnated with chloroplatinic acid in such a manner that the platinum deposited on the base is fixed and cannot be washed off the base even prior to reduction. The cracking component and the aqueous platinum solution are subjected to a temperature of 190-230°F (while maintaining a substantially constant moisture content) for a time, sufficient to effect fixation.

Better catalytic performance of a platinum-alumina catalyst can be obtained according to J. A. Dinwiddie and M. A. Mosesman in Esso Res. & Eng. Co.'s 2,761,819, if the catalyst is pretreated with hydrogen at 1000-1300°F and atmospheric pressure for periods of 2-24 hours, this time being 1-10% of the total contact time of the catalyst with hydrogen and oil.

Catalyst Regeneration

The number of patents on this subject is increasing sharply, reflecting attempts to improve fluidized bed hydroforming operations and to arrive at regenerative platinum catalysts.

According to one of a large group of patents issued to Esso Research & Engineering Co., J. Weikart (2,765,262) reforms naphthas over a fluidized halogen containing platinum-alumina catalyst at low pressures. Fouled catalyst is withdrawn and regenerated by burning with an oxygen containing gas in a separate fluid bed. Care is taken to avoid complete combustion of carbonaceous material and to retain 0.3 to 0.5% coke on the catalyst. (See accompanying figure.) W. G. Scharmann and A. F. Kaulakis in 2,756,189 employ the same idea for a supported group VI hydroforming catalyst leaving 1-4 wt.% coke on the catalyst returned to the reactor. Kalaukis in 2,756,188 employs a group VI or VIII regenerated catalyst still containing 1-4% coke in the reactor in a catalyst to oil ratio of 5-20 and for a residence time of 10-20 minutes. By this combination of expedients, oxidation and reduction of the catalytic metal or metal oxide is almost completely avoided. Spent group VI hydroforming catalysts, which cannot be restored by oxidative regeneration, are, according to 2,749,287 (I. Kirshenbaum), first freed of carbonaceous deposits and then treated with an oxygen containing gas also containing 1-5% of water. This is followed by treatment with a dry, oxygen containing gas and with a hydrogen containing gas.

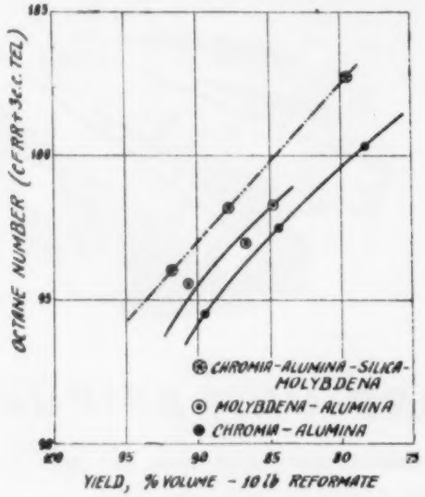
In another in the group of Esso Res. & Eng. Co. patents (2,751,332) E. J. Gornowski and W. C. Rich, Jr. are concerned with the recovery of the sensible heat acquired by the catalyst during regeneration. The regeneration is carried out in two zones. A minor proportion of catalyst is completely regenerated with air in the lower zone and combustion gases containing unconsumed oxygen are passed to the upper zone, where incomplete regeneration of the major amount of catalyst occurs. Both catalyst portions are returned to the reaction zone. C. E. Hemminger (2,746,909) describes a fluidized bed reforming process, employing a platinum containing catalyst. The catalyst is regenerated in a regeneration zone and is then treated with dry hydrogen or recycle gas to remove CO_2 or water, both of which adversely affect catalyst activity and selectivity.

Regeneration of coked platinum catalysts with hydrogen is discussed in three other Esso patents. According to 2,764,528 (W. J. Sweeney), a slurry of spent catalyst in a high boiling naphthenic oil is hydrogenated at 1000-10,000 psi and 600-900°F. A thickened slurry of regenerated catalyst is separated from re-cycle oil and is combined with at least an equal volume of low boiling wash oil. The thin suspension is cooled and depressured. A wet cake of regenerated catalyst is recovered and washed again in a hydrogen atmosphere. Catalyst particles are dried in a hot hydrogen containing gas. D. D. MacLaren and O. Schricker (2,758,-063) remove coke from platinum catalysts by treatment with a hydrogen rich recycle gas, which contains less than 0.5% C_4+. The treating temperature is about 1000°F. C. E. Hemminger in 2,757,128 continuously withdraws a platinum-alumina-fluorine catalyst from a fluid catalyst bed and treats it with hydrogen to remove carbonaceous materials therefrom.

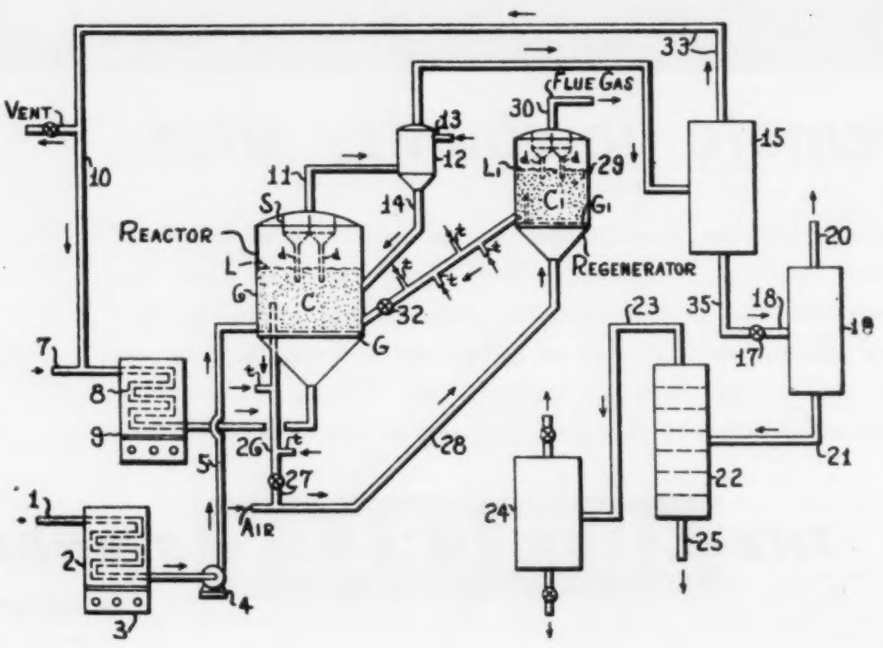
U.O.P. patent 2,758,098 (V. Haensel) discloses the restoration of the aromatizing characteristics of a coked platinum-alumina-halogen catalyst by means of treatment with carbon dioxide at 1100-1400°F.

Three Esso Res. & Engineering Co. patents deal with regeneration of hydro-forming catalysts deactivated in operation with sulfur containing stocks. R. J. Fritz in 2,756,191 accomplishes this by alternating oxidation and reduction of the spent catalyst. Molybdenum sulfide is first partly converted to sulfur dioxide, any sulfate formed is then reduced and eventually again oxidized to SO_2. C. E. Hemminger in 2,762,752 prevents oxidation of molybdenum sulfide to sulfate by regenerating spent catalyst first with a gas containing 0.5-3% oxygen and later with a gas containing 21% oxygen to complete combustion of carbonaceous deposits. A. Voorhies and W. M. Smith in 2,752,288 suggest a pretreatment of spent hydroforming catalyst prior to combustion. The coked catalyst, containing sulfur bodies is treated with a gas containing free hydrogen at a partial pressure of 5-15 psi. This treatment is carried out at 900-1200°F for 1-60

U.S. Patent 2,757,145: W. A. Stover, Method for Preparing a Reforming Catalyst



U.S. Patent 2,765,262: J. Weikart, Reforming with a Platinum-Alumina Catalyst



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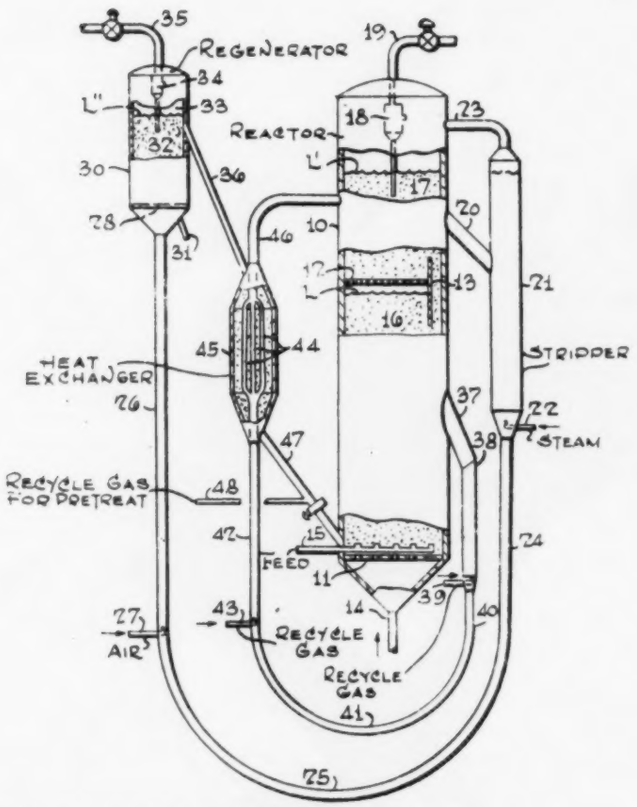

U.S. Patent 2,758,959: L. A. Nicolai, Fluid Hydroforming Process

minutes and removes most sulfur bodies.

V. Haensel's patent 2,752,289 (to Universal Oil Products Co.) relates to a process for removing chlorine from a platinum-alumina catalyst, which comprises treating the catalyst with an aqueous solution of ammonium nitrate.

Fluid Hydroforming

The great majority of patents in this group is assigned to Esso Research & Engineering Co. and these patents will be treated first.

According to R. J. Fritz in 2,749,285 naphthas are reformed over molybdena or platinum type catalysts with the fluidized solids technique. A stream of catalyst particles is withdrawn from the reactor and is contacted with a stream of hot gas, which serves to heat the particles above average reactor temperature and which carries the catalyst to a gas-solids separator above the reactor. Hot solids are cycled back to the reactor. The gas is recompressed, reheated to 1200°F and recycled to the conveying and heating of reactor catalyst. W. J. Mattox (2,756,187) regenerates hydroforming catalyst in a separate regenerator at 1150-1250°F. The regenerated catalyst is stripped with a dry inert gas, cooled to reactor temperature, mixed with naphtha feed vapors and the resultant mixture is rapidly discharged into the dense, fluidized bed in the reactor. W. A. Rex in 2,752,291 describes a system in which part of the catalyst regeneration is accomplished in the transfer line from reactor to regenerator. Catalyst circulation is controlled with considerable sensitivity by providing a temperature responsive controller in the spent catalyst riser to the regenerator, which actuates the slide valve in the spent catalyst stand pipe. R. J. Yoder's patent 2,765,260 discloses a modification of a fluid bed hydroforming process in which regenerated catalyst is cooled by indirect heat exchange with spent withdrawn catalyst, is then treated with hydrogen to reduce molybdenum oxide, and is lifted by the hydrogen rich gas stream to the reactor zone. R. J. Fritz and L. A. Nicolai (2,765,263) continuously withdraw spent catalyst from a hydroformer reactor and regenerate it in a separate zone at elevated temperature and substantially the same pressure prevailing in the reactor. Regenerated catalyst is then treated with hydrogen in a separate zone and at the same pressure. L. A. Nicolai, in 2,758,959 (see accompanying drawing) describes a process, in which two dense phase fluid beds are maintained in the reactor with catalyst passing from the lower to the upper bed. Between the two beds, the catalyst is in indirect heat exchange with freshly regenerated catalyst to provide for higher temperature in the upper bed and to cool regenerated catalyst for use in the lower bed. According to 2,760,910 and 2,760,911 (R. J. Fritz, J. F. Moser, L. A. Nicolai and E. W. J. Nicholson) a stream of catalyst particles is constantly withdrawn from the reactor bed, regenerated in a different zone, purged and deposited in a high velocity hydrogen rich gas stream, which conveys the catalyst to the upper part of the reactor. There it is disengaged and deposited in the fluidized catalyst bed and the hydrogen rich gas is discharged into the product vapor stream.

A Gulf Research & Development Co. patent (2,760,917 J. V. Ward) relates to an improved method for the fluidization of catalyst beds. J. F. Snuggs and C. M. Walker (2,761,820 to Standard Oil Co. of Indiana) have found that, when regenerated hydroforming catalyst is contacted with hydrogen, there is not only water vapor formation but also liberation of sulfur dioxide, apparently by replacement of sorbed SO_2 with H_2. A method of constructing and operating a unit is described, which avoids the presence of water and sulfur dioxide in the dense catalyst phase.

Multistage Processing

This section deals with patents which describe combinations of processing steps, either during the reforming operation itself or involving sequences of pretreating, reforming and treatment of reformed products.

According to Universal Oil Products Co's 2,758,064 (V. Haensel) a nitrogen and sulfur containing naphtha is first hydrotreated over cobalt-molybdena-alumina or platinum-alumina catalyst to convert the non-hydrocarbons to ammonia and hydrogen-sulfide. The effluent from this step is cooled and condensed, the hydrogen-rich gas stream is scrubbed to remove NH_3 and H_2S and the liquid fraction is distilled to remove dissolved NH_3, H_2S and light gases. The impurity free liquid fraction is then vaporized and contacted with the scrubbed hydrogen in a reforming zone over a platinum-alumina-halogen catalyst. In another U.O.P. patent (2,768,126), Haensel and H. W. Grote saturate an olefinic hydrocarbon fraction in the gasoline boiling range over a sulfur resistant hydrogenation catalyst at 550-850° and 100-800 psig. The resultant saturated fraction is reformed over a platinum-alumina halogen catalyst at 600-1000°F and 50-500 psig. The liquid reformate is separated into aromatic and non-aromatic hydrocarbons and the latter are hydrocracked at 550-750°F and 500-2000 psig. Hydrocracked products are fractionated into high boiling motor fuel and a low boiling aviation fuel fraction.

A two stage reforming process is disclosed by G. C. A. Schuit and M. T. Hart in Shell Dev. Co.s 2,767,125. Hexamethylene ring naphthenes are selectively dehydrogenated over a non-acidic catalyst, such as platinum on silica, or tungsten or nickel on a non-acidic support at 450-500°C and 30-100 atm. pressure. The products from this step are then contacted with an acidic dehydrogenation catalyst, such as platinum on a HF treated carrier to convert pentamethylene ring naphthenes to aromatics. Following a similar scheme, E. Arundale, W. R. F. Guyer and J. P. Thorn (2,758,062 to Esso Res. & Eng. Co.) contact naphtha in a first stage with platinum or palladium catalyst on alumina, which is substantially free of fluorine or silica. Naphthenes are converted to aromatics, but little cracking and paraf-

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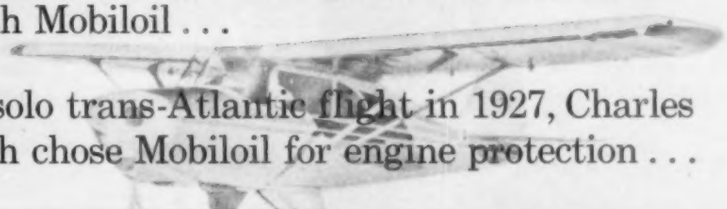

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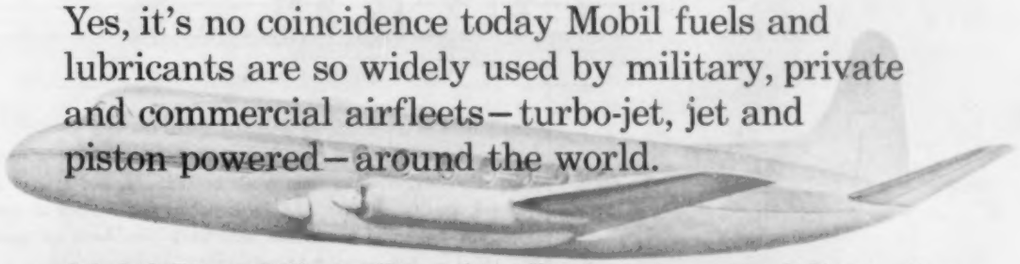

Mobil Pays Off—in Progress, Performance and Protection

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fin isomerization or aromatization occurs. This step is non-regenerative. In a second stage, the products from the first stage are treated over a group VI reforming catalyst to obtain paraffin conversion reactions. This step is regenerative.

A method for selectively dehydrogenating C_6 ring naphthenes in a gasoline fraction without any conversion of paraffins, such as n-heptane, is disclosed by A. G. Oblad and H. Heinemann in Houdry Process Corp.'s 2,760,999. The catalyst comprises 0.1-2% platinum on a non-acidic silica or titania gel. Temperatures of 850-975°F, pressures of 400-1000 psig and space rates of 1-6 are employed.

A reforming process without a hydrogen recycle system is described by L. F. Pasik in Universal Oil Products Co.'s 2,765,264. A gasoline fraction is contacted with a platinum-alumina catalyst at aromatizing conditions. Liquid products are separated from hydrogen produced and cut into a plurality of streams, each of which is separately commingled with all of the hydrogen from the aromatizing step and reformed over a platinum-alumina-halogen catalyst.

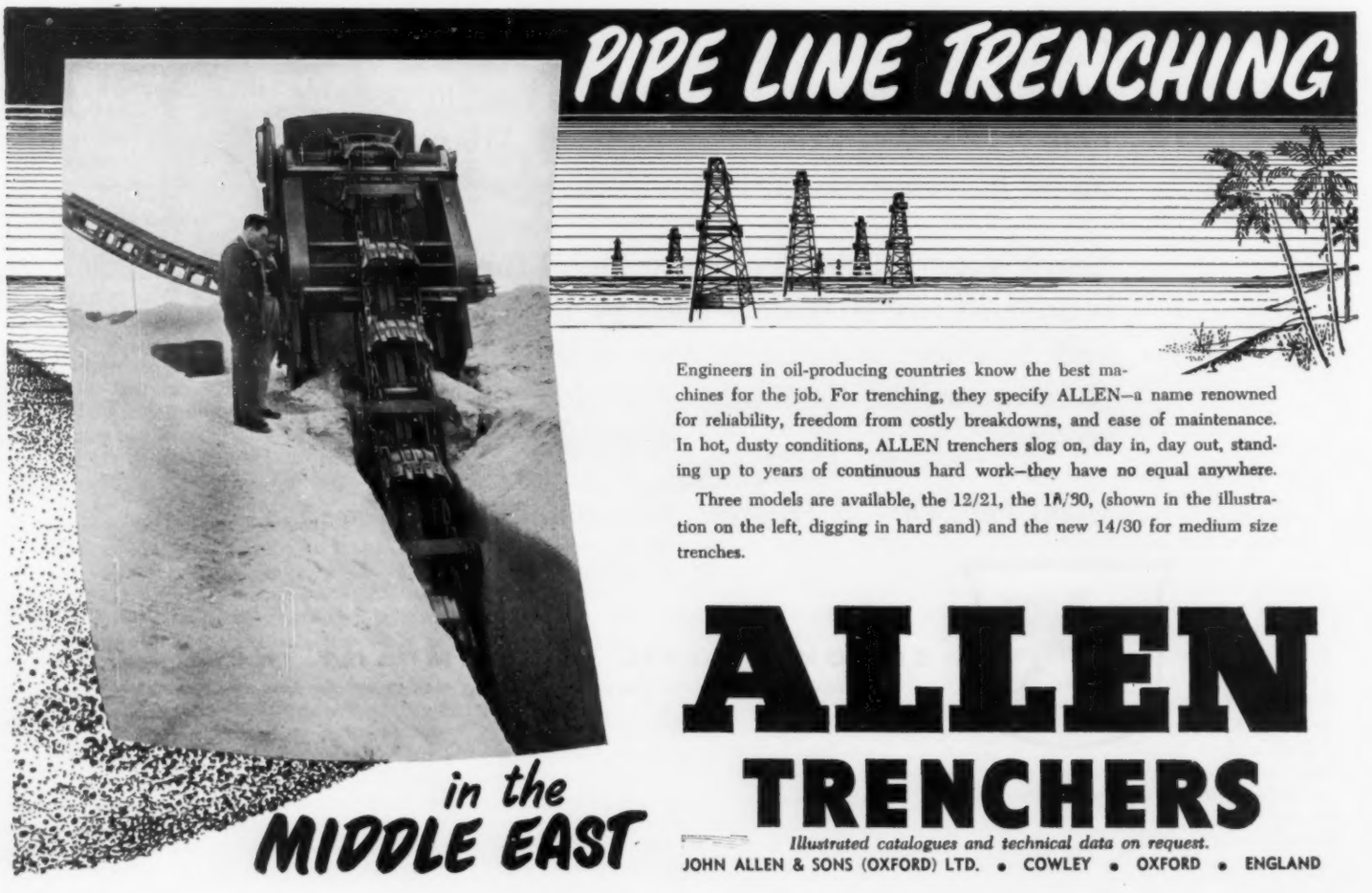
Heat Balanced Operation

K. M. Elliott (2,763,598 to Socony-Mobil Oil Co.) discusses a method for regulating the ratio of vapor stream heat capacity and catalyst stream heat capacity of a moving bed reforming unit within described limits and for closely regulating temperature control of all parts of the catalyst bed. R. J. Fritz (2,763,595 to Esso Research & Engineering Co.) proposes a heat balanced hydroforming operation, utilizing an inert solid heat transfer medium, which circulates with the catalyst between the reactor and regenerator in a particular manner. A mixture of at least 4:1 parts of catalyst to inerts is maintained in the reactor. Withdrawn mixture is elutriated, part of the elutriated catalyst is recycled to the reactor and a mixture of 3-4 parts of inert per part of catalyst is charged to the regenerator. The regenerated mixture is returned to the catalyst zone of the reactor where the inerts supply most of the heat of reaction. In another Esso Res. & Eng. Co. patent (2,768,-124) R. L. Berg and G. D. Ward describe improvements in supplying heat to the reaction zone of a reformer. Recycle gas, containing hydrogen and C_1-C_6 hydrocarbons is scrubbed to remove C_4 and higher hydrocarbons. The scrubbed gas is heated to cause dehydrogenation of the remaining lower paraffins to olefins. These are fed to the reaction zone, where they are hydrogenated with the release of heat in situ.

Miscellaneous Reforming and Dehydrogenation Patents

The effect of carbon dioxide on reforming catalysts is discussed in Sinclair Refining Co.'s 2,759,876 (J. W. Teter and R. H. Elkins). Small amounts of CO_2 poison the acid function of fluorine promoted platinum-alumina catalysts. Hydrogen rich recycle gas is, therefore, washed with alkanolammine to remove traces of CO_2, prior to readmitting it to the reactor.

The dehydrogenation of C_6 and higher paraffins to olefins is the subject of I. Kirshenbaum's 2,754,345 (to Esso Res. & Eng. Co.). The reaction is carried out in the presence of 1-25 mol % steam at 950-1050°F with a catalyst comprising 60-80% alumina, 20-40% chromia and 1-15% (calculated as K_2O) of a potassium compound.



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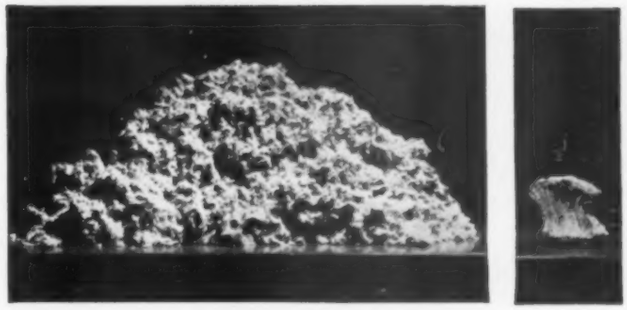

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MEAN TEMPERATURE °F.			250			350			450		
Nominal Pipe Size	O.D. pipe	Thickness of Insulation	Heat Loss B.Th.U. sq. ft. hr.	Effic. %	Surface Temp. °F.	Heat Loss B.Th.U. sq. ft. hr.	Effic. %	Surface Temp. °F.	Heat Loss B.Th.U. sq. ft. hr.	Effic. %	Surface Temp. °F.
6"	6⅛"	1"	135	87·7	126	233	90·6	167	354	92·5	218
		1½"	102	90·8	107	177	92·9	135	270	94·3	171
		2"	83·6	92·4	97	145	94·1	118	223	95·3	145
		2½"	71·8	93·5	91	125	95·0	107	192	96·0	128
		3"	63·5	94·2	86	110	95·5	100	170	96·4	117
		3½"	57·3	94·8	83	100	96·0	95	154	96·7	109
		4"	52·6	95·2	81	91·7	96·3	91	142	97·0	103
8"	8⅛"	1"	130	88·0	127	225	90·8	169	341	92·7	222
		1½"	97·7	91·0	108	169	93·1	137	258	94·5	174
		2"	79·2	92·7	98	138	94·4	120	211	95·5	148
		2½"	67·4	93·8	92	117	95·2	109	180	96·1	131
		3"	59·2	94·6	87	103	95·8	102	159	96·6	120
		3½"	53·2	95·1	84	92·7	96·2	96	143	96·9	111
		4"	48·5	95·6	82	84·6	96·5	92	131	97·2	105

These figures are compiled from results of official tests by THE NATIONAL PHYSICAL LABORATORY, TEDDINGTON, computed in accordance with formulae shown in BRITISH STANDARD SPECIFICATION appendices.

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The Soviet Gas Industry

(*Continued from page 40*)

being extended to the Gorki industrial center. The other line soon will supply Magnitogorsk, which is Russia's main metallurgical center.

The third development in the Ural-Volga area is the oldest, and centers around the Sultangulovo gas field discovered during the last war. Another discovery was made in 1951 at Mukhanovo, on the banks of the Kinel River, where the gas deposits lie at a depth of only 1,200 ft. From Sultangulovo, one pipeline crosses the Kuibyshev province, and supplies Syzran and Ulyanovsk; the other branches southward to the Chkalov province, which is regarded today as the best gas-supplied region in the entire Soviet Union.

Gas reserves of the Ural-Volga basin are very great, and the geological work carried out here during recent years without doubt has located several other gas fields. It may be presumed that the existing and projected gas pipelines within and from this area are not the last word in gas developments in the "second Baku."

Of equal importance are also the gas riches of the Trans-Caucasian and northern Caucasian regions. In the latter region, the Grozny gas reserves, discovered after 1950, are of a considerable value. Only one pipeline is planned to carry the Grozny gas to Tbilisi.

In the Dagestan republic, along the Caspian shores, there are important gas deposits at Makhach-kala and Darbent, where the main producing fields are Dag Ogni, Menzil, and Dazlak.

The gas reserves of the Azerbaijan republic may equal those discovered at Stavropol. The Prolific gas resources of the Molotov and Orzhonikidze Rayons have been known for many years. To these are added the Duvannyi and Karadag deposits discovered in 1954—which are, reportedly, extremely rich. In 1955-56, six additional gas fields were opened up here. One pipeline will be completed befor 1960 to carry gas from these deposits to the Sumgait refining and chemical center as well as to Kirovabad, which is the second industrial center of Azerbaijan. Despite the enormous gas reserves of this republic, there is only one medium-size gasoline plant in the whole of Azerbaijan. Conservation methods are being introduced very slowly. As previously mentioned, the amount of gas blown into the air in the Azerbaijan republic is conservatively assessed at 37 billion cubic feet annually.

Newest addition to the Soviet gas fields is the discovery made in 1953 of a large deposit in the western Siberian basin, on the lower reaches of the Ob River. This discovery offers new and very good prospects for the entire Ob-Irtysh basin, as well as for the arctic and subarctic regions. It gave impetus to a more intensive geological search for gas and oil in the whole western Siberian basin. The first gas development is at Berezovo, from which a line is under construction to carry gas to Sverdlovsk, Russia's second metallurgical center. From here, the pipeline will continue to another iron and steel center, Chelyabinsk, which is slated to be supplied with gas by 1960.

Russia has two shale-gas developments of industrial importance. The major one is processing the shale deposits located around Peipus Lake as well as their extension in the Leningrad area. Since the last war these deposits have been expanded considerably because the area was devoid of fuel sources and poor in energy. Shale mining and processing at Kokhtla Yarve started a quarter of a century ago, but were limited to Estonian domestic needs alone. Since 1945 these facilities were enlarged further with a view to supplying gas to Slantsy, Leningrad, and Vyborg (since 1947-48) and Tallin (since 1953). A new shale-processing plant is under construction at Akhtma, on the banks of Peipus Lake, which will supply gas to Riga through a pipeline to be finished before 1960.

Shale mining by now may amount to 15 million tons per year. The increase is due not only to the need for supplying raw material for gas production, but also because the lower dark shale layer (the dichtyonema) is rich in potash, vanadium, and uranium. Shale is processed at three industrial units: Eestpolevkivi (the Estonian Shale Kombinat), the Kokhtla Yarve Shale Processing Kombinant, and the Xaardu Chemical Fertilizer Kombinant. The shale-oil production has been slowed down recently, and new experimental work is being done to find a less costly gas-generating furnace.

Russia's second shale development is located at Kashpir, near Syzran, in Kuibyshev province, where there are large deposits of bituminous shale. The gas produced is being fed into the pipeline crossing this area.

Additional shale developments may be started in the Cheremkovo basin, west of Baikal Lake, where there are presumed to be Russia's largest shale deposits. This project will be delayed until after 1960 when the large hydroelectric plants now under construction on the Angara River will be finished.

Russia's gas pipeline network was approximately 4,900 miles long at the end of 1955. It is planned to lay 5,600 miles of additional pipelines before 1960. Of this, 850 miles will be "big inch" carriers, with a diameter between 25 in. and 30 in. Further plans provide for the laying of almost 4,000 miles of gas mains and service lines in 130 towns.

No information has been given out as yet as to diameter and pressure of the new pipelines. It is known, however, that most of the new lines will be at least as large as the one connecting Saratov with Moscow. This 527-mile line has a diameter of 12 in. and a maximum capacity of 18 billion cubic feet of gas per year. The gas is compressed in 6 stations; each is equipped with 4 1,000-hp compressors. All 24 compressors were delivered to Russia, during the last war, by the US government under the lend-lease program. At the starting point, in Saratov, the gas is passed through a cleaning station where moisture and uncombustible substances are eliminated. In Moscow the gas is received in a distribution control center, where the pressure is lowered before the gas is pumped into the distribution centers. The Saratov-Moscow line served Soviet technicians and planners as an experiment and a school to help plan future projects.

The Stavropol-Moscow pipeline, which will be ready by the end of this year, will be approximately 900 miles long, and will cross and supply 42 major towns on its way northwards. The use of multiscoop excavators and of automatic pipe-welding machines, as well as of joints 130 ft long, expedited the laying of this line. The gas line has a 28-in. diameter. When finished, it will compare favorably with western achievements.

More than 250 industrial plants will be switched from coal to gas fuel before 1960. Among them are such giant metallurgical centers as Magnitogorsk, Sverdlovsk, Chelyabinsk, as well as major enterprises in Moscow and Leningrad, the gas consumption of which is counted in tens of billions of cubic feet per year.

The switch to gas will aid the Soviet economy because it will lower production costs, cut down the periods of inactivity when plants are idle because of fuel shortage, and free the overburdened Soviet railways of a great load of solid-fuels transportation.

Private consumption will gain little from this expanded gas program. During the 1956-60 period, 1,250,000 rooms are planned to be supplied with gas. This represents twice as many rooms as were reported to have been supplied during the previous plan. This figure, in itself, is very modest if compared with Russia's natural increase rate of three million people per year.

Introduction of natural gas into dwellings is retarded by the shortage of gas meters, ranges, stoves, water heaters, pressure regulators, etc. These are minor items for the Soviet industrial capacity, but their production is simply not included in the plan.

The plan provides for increased production of petrochemicals from natural gas. Present activity in this field is relatively small. In addition to the "food waste" instance quoted by Mr. Khrushchev, here is another example revealing the Soviet progress in petrochemicals. Out of 530 billion cubic feet of coking gas produced in 1955, only 27 billion were processed for obtaining ammonia or other byproducts. The remainder was used as fuel in metallurgical plants.

Increased use of natural gas is planned as a substitute for oil products for the propulsion of motor cars and trucks. It has been calculated that 135 cu ft of compressed gas replace 1 gal of gasoline. Gas filling stations are seen in many western Ukrainian towns; in Lvov, Kiev, Saratov, and Moscow. The output of natural gasoline and of LPGas is planned to increase 6½ times between 1956 and 1960. END

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Surface Coatings

(Continued from page 55)

but also of the dry film—from which they will not evaporate at appreciable rate. In this field, the plasticizers of principal interest to the petrochemical industries are various phthalate esters. Some condensation products of glycol (e.g., with terephthalic acid, with sebacic acid) also find specialty applications as plasticizers in coatings formulations.

Chemicals, within the meaning of the surface-coatings industry, find their largest application in the improvement of drying oils. These oils, like the group of resins, serve as film-formers; but, whereas film formation by resins is dependent on evaporation of the paint vehicle only, the drying oils must be oxidized or polymerized *in situ*. The choice of resin vs. drying oil depends on the purpose which is to be served by the coating and on the method by which the paint is applied.

Natural oils (linseed, tung, fish, soybean, castor oil, etc.) form the base of drying oils. The principal chemicals employed toward their upgrading are the same ones which figure most prominently in the production of synthetic resins, notably dibastic acids and polyhydric alcohols. Direct chemicals' consumption by the surface-coatings industry in 1955 had the estimated distribution pattern as shown in Table IV.

TABLE IV

Estimated Distribution of Chemicals Used Directly in Surface Coatings

	% of Dollar Volume
Phthalic anhydride	32
Glycerol	20
Pentaerythritol	16
Styrene and homologues	8
Phenols	6
Formaldehyde	5
Maleic anhydride	4
Others	9

Two other groups of raw material for surface coatings draw ultimately on petrochemical sources, but their impact in dollar volume is of relatively minor significance. First, there are the organic colors, referred to as "toners," a term which covers a variety of dyes including phthalocyanines, indanthrenes, toluidines, etc. In their synthesis, phthalic anhydride, toluene, etc., play a part as intermediates.

Second, there is the group of metallic driers which are provided in the form of oil-soluble salts, notably of naphthenic acid. The leading members of this class are the naphthenates of lead, cobalt, and manganese.

This, then, is the situation of petrochemicals consumption in the surface-coatings industry: A large number of petroleum-derived chemicals play a significant role in this market. The more important of these find numerous different applications. Furthermore, as we shall see in Part II to be published in an early issue, several of these chemical commodities are dependent on the surface-coatings industries for the bulk of their sales.

Table V summarizes how the more important of these petrochemicals are used in surface coatings, and by what route they are commercially derived from petroleum sources.

TABLE V

Derivation and Utilization of Principal Petrochemicals Consumed in Surface Coatings

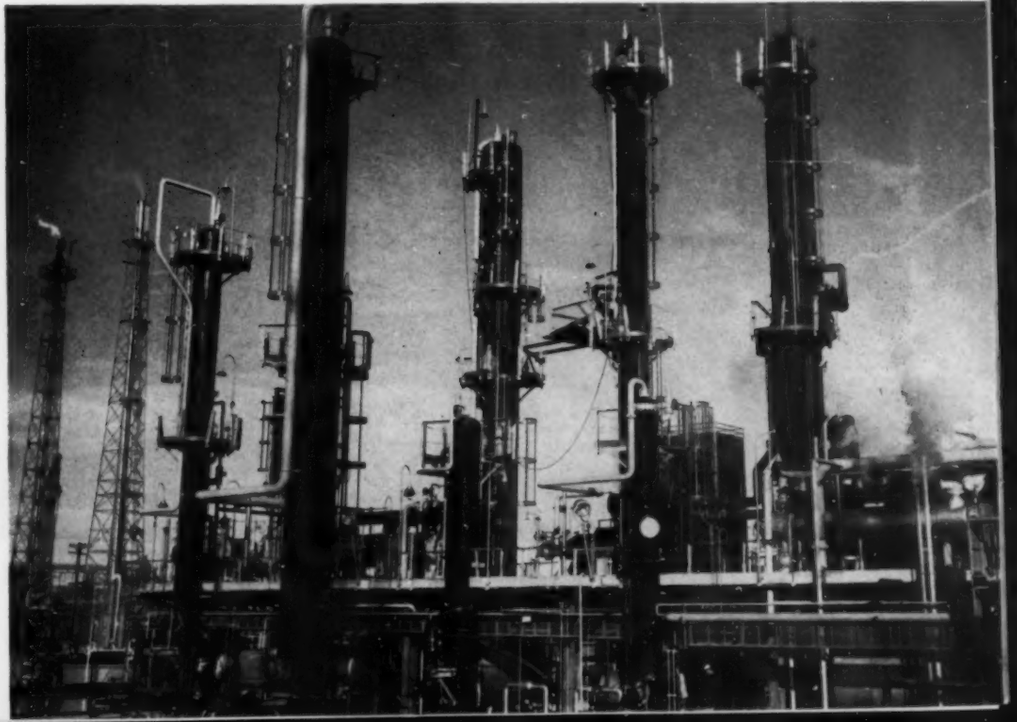
Key: C—chemicals
D—driers
I—intermediate. This designation is applied only to compounds listed in Table V which serve as intermediates for other compounds included in the same table.
R—resins
S—solvents and plasticizers
T—toners

Compound	*Use*	*Petroleum Derivation*
Acetaldehyde	R,C,I	1) Ethylene→ethanol→acetaldehyde 2) Methane→acetylene→acetaldehyde 3) Propane-butane→acetaldehyde
Acetone	S,I	1) Propylene→isopropanol→acetone 2) Cumene→acetone
Bisphenol-A	R	Phenol (I)+acetone (I)→bisphenol-A
n-Butanol	S	Acetaldehyde (I)→n-butanol
Epichlorohydrin	R	Propylene→allyl chloride→epichlorohydrin
Ethyl alcohol	S,I	Ethylene→ethanol
Formaldehyde	R,C,I	1) Methane→methanol→formaldehyde 2) Butane-Propane→Formaldehyde
Glycerin	R,C,S	1) Propylene→allyl chloride→diglyceryl chlorohydrin→glycerine 2) Propylene→acrolein→glycerine
Isopropyl alcohol	S,I	Propylene→isopropyl alcohol
Maleic anhydride	R,C	Benzene→maleic anhydride
Methyl ethyl ketone	S	Butylene→sec-butyl alcohol→methyl ethyl ketone
Methyl isobutyl ketone	S	Acetone (I)→Diacetone Alcohol→mesityl oxide →MIBK
Naphthenic Acids	D	Direct Recovery
Pentaerythritol	R,C,S	Formaldehyde (I)+Acetaldehyde (I)→pentaerythritol
Phenol	R,C	1) Benzene→chlorobenzene→phenol 2) Benzene→benzenesulfonic acid→phenol 3) Cumene→phenol plus acetone
Phthalic Anhydride	R,S,C,T	o-xylene→phthalic anhydride
Styrene	R,C	Benzene+ethylene→ethyl benzene→styrene
Toluene	S	Direct recovery
Urea	P	Methane → Ammonia, Carbon Dioxide → Urea
Vinyl acetate	P	Acetaldehyde (I)→acetic acid, Methane→acetylene → vinyl acetate
Vinyl chloride	P,C	1) Ethylene-dichloroethane→vinyl chloride 2) Methane→acetylene→vinyl chloride
Xylenes	S	Direct Recovery

Salient statistics and significance of the petrochemical industries of several of these materials will be dealt with in Part II of this article.

Note: End of Part I. Bibliography will appear at end of Part II. END

Fig. 3 Monsanto Chemical Co.'s Vinyl-Chloride Plant at Texas City, Texas (Courtesy Monsanto)



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Oil Company Staff Changes

C. A. WIGGINS, resigned as president of Drilling and Exploration Co., Inc., on December 31, 1956. Mr. Wiggins stated that he was taking this action at this time for purely personal reasons. Charles R. Rider, chairman of the board and chief executive officer was elected to succeed Mr. Wiggins, who has agreed to remain with the company for a period of three years in a consulting capacity.

WILLIAM F. KENNEY, vice president and general counsel of Shell Oil Co., has been elected chairman of the American Petroleum Industries Committee, to succeed Robert H. Scholl, vice president and director of Esso Standard Oil Co., who has served as chairman the past two years. Henry L. O'Brien, general counsel and director of Cities Service Co. was elected to succeed Mr. Kenney as vice chairman.

R. B. STEWART has been promoted to manager of Phillips Petroleum Co.'s natural-gas department to succeed A. M. Rippel, who died December 12 in the crash of a company plane near Bartlesville, Okla. **DAN L. MAYER,** formerly general superintendent of the department, has been advanced to replace Mr. Stewart as assistant manager. **M. H. CULLENDER,** previously gas sales representative at Amarillo, Texas, was named director of the department's engineering division. The former coordination and gas settlements division have been consolidated into a services division, with C. T. Dickerson as director.

C. L. PARKHILL, JR. has joined California Western Gas Co. as executive vice president. He had previously been affiliated with Anchor Petroleum Co. as general manager of its western and Canadian division.

John F. Conway

John F. Conway, 62, publicity director of Sinclair Oil Corp., died at the Flower Hospital following a short illness. Mr. Conway joined Sinclair in its advertising department in 1923. Prior to that time he had been employed in his family's textile business.

WILLIAM W. CLAWSON, president of Mobil Producing Co. and Mobil Oil of Canada Ltd., became coordinator of domestic production and a member of the producing committee of the parent company, Socony Mobil Oil Co., effective January 1. Replacing him at headquarters in Billings, Mont., will be Edward C. Cram, coordinator of domestic production.

Charles G. Cooper

CHARLES G. COOPER has been elected a vice president and director of Cooper-Bessemer Corp., and as vice president of Cooper-Bessemer International, Cooper-Bessemer Overseas Corp., and Cooper-Bessemer of Canada Ltd. He transferred to the export offices of New York from the southeastern district office at Washington, D. C., where he had been in charge of government and district sales.

Delta Appoints Houston Manager

Frank M. Black has been appointed Houston area branch manager of Delta Tank Manufacturing Co. Inc.'s oil-field equipment division. He formerly was with Humble Oil & Refining Co.'s production research department.

Van Vranken Heads ESCO Sales

Leonard J. Van Vranken has been appointed sales manager of Engineering Supply Co., distributor of industrial, electronic, geophysical, power-transmission, and safety supplies throughout the Southwest, representing some 500 manufacturers. Engineering Supply Co. is a subsidiary of Texas Instruments Inc. Mr. Van Vranken previously was Southwest division district manager for the Lewyt Corp.

DR. HEINZ HEINEMANN has been elected president of the newly organized International Congress on Catalysis. Re-election of Dr. Heinemann and Dr. Alex G. Oblad to the board was also announced. Dr. Heinemann is section chief in charge of process research at the Houdry laboratories in Linwood, Pa. He was formerly executive secretary of the congress and past chairman of the Catalysis Club of Philadelphia. Born in Berlin, Germany, he is author of numerous publications, many in World Petroleum, and patents on catalytic and petroleum chemistry; and had worked for several petroleum companies and catalyst manufacturers.

JOHN M. DONNA, engineer of Geophysical Services, Inc., has been commissioned by Petroleos Mexicanos to supervise exploration in the Tabasco Valley.

H. P. ARBUCKLE and **P. SUPERTY, JR.** have been elected assistant comptrollers of Gulf Oil Corp.

MARTIN H. MITCHELL has been named general manager of Tidewater Oil Co.'s operations in Turkey. He succeeds Jay T. Gist, who has been transferred to Beirut, Lebanon.

In his new post, Mr. Mitchell will direct oil exploration on approximately 2,500,000 acres of land held under exploratory licenses by Tidewater jointly with Atlantic Refining Co. and Seaboard Oil Co. His headquarters will be in Ankara. He goes to Turkey from San Francisco where he was manager of Tidewater's western division land department.

Russell W. Anderson

RUSSELL W. ANDERSON has been named manager of newly formed Industrial Engineering Dept. of Geophysical Service Inc. His duties will include cost estimating and analysis, and budget control. His department also will coordinate policies and procedures for GSI's worldwide organization, as well as administer a work-simplification program for its geophysical exploration field parties.

Bryce B. (BO) Curry

BRYCE B. (BO) CURRY, familiar geologist and oil-industry figure for more than 25 years, has joined Independent Exploration Co., one of Houston's oldest and largest exploration companies, as the firm's service co-ordinator.

B. I. Graves

B. I. GRAVES, petroleum consultant, San Francisco, has been elected a director of Natomas Corp., a corporation which has been engaged in gold dredging in California for many years. The Natomas Corp. recently acquired a substantial interest in the American President Lines Ltd., a worldwide shipping concern. Natomas also plans to expand and broaden its operations into other profitable fields of industry and investment.

Carl A. Vill

CARL A. VILL has been appointed assistant to the vice president of Chemical Construction Corp. He has served the company as director of engineering, as well as project manager on numerous chemical and petrochemical plants.

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Sun to Operate in Latin America, Bahamas, Pakistan

Sun Oil Co. has organized a foreign operations department and formed several subsidiary companies to engage in oil exploration and production activities in Latin America, the Bahamas, and Pakistan.

Ted C. Stauffer, Philadelphia, formerly manager of Sun's central production division, Evansville, Ind., and more recently administrative assistant to the vice president in charge of production, has been appointed director of foreign production operations, a new post.

The principal division thus far established of the new department is a Latin America division, of which B. E. Warren, Dallas, has been appointed manager. Mr. Warren formerly headed the natural-gas department of the company's southwestern production division at Dallas. He was associated with Sun in Venezuela from 1920 to 1925.

Assisting Mr. Stauffer in the management of the new department are Winfield Givens, who serves as foreign representative for the department in addition to managing Sun's land department in Philadelphia; Herbert J. Weeks, Philadelphia, whose appointment as geological counselor for foreign operations was announced recently; and J. W. Timmins, Dallas, formerly general attorney of the company's southwestern production division, and now special counsel for foreign operations.

Mr. Warren's Latin America division is organized into three main departments—geology and geophysics, headed by Paul W. McFarland, Dallas; operations, by Kenneth E. Montague, Maracaibo; and accounting and purchasing, by Davis B. Crow, also Maracaibo.

Mr. McFarland, who served as a geologist for Sun in Venezuela in the early 1920's, has most recently been assistant chief geologist for the southwestern production division. Mr. Montague formerly was supervisor of the reservoir study section of the company's Gulf Coast production division, headquartered at Beaumont; and Mr. Crow was section supervisor in the gas accounting department of the southwestern production division.

Earl B. Wilson Jr. has been appointed assistant to the division manager for Latin America. He formerly was an oil scout and landman in Sun's central production division.

Mr. Stauffer is president of three of the subsidiary companies announced by Mr. Pew—Venezuelan Sun Oil Co., Colombian Sun Oil Co., and Pakistan Sun Oil Co. Mr. Warren is vice president and general manager of the first two of three companies. Other subsidiary companies involved in Sun's expanding foreign activities are Sun Production Co. of Bahamas and Sun Production Co. (Del.), operating in Guatemala. Sun operates in Cuba and Canada under the name of the parent company.

John G. Pew, Sun production vice president, pointed out that Sun recently has been successful, in association with other companies, in bidding for oil concessions in Venezuela and Guatemala. It has held a concession in Cuba for some years, and recently acquired a large concession in the Bahamas. Currently the company is negotiating for exploration interests in Colombia and Pakistan.

Although the new foreign operations department is still in the formative stages, a number of appointments have been made to staff the growing organization in Latin America. In addition to those already named, Ira D. Weatherford has been appointed drilling superintendent at Maracaibo, assisted by W. W. Delahoussaye, junior petroleum engineer. Mr. Weatherford formerly was a tool pusher in the Gulf Coast production division, and Mr. Delahoussaye was employed by Manabi Exploration Inc., in Guayaguil, Ecuador.

Louis H. Johnson Jr., formerly of the gas accounting department of the southwest production division, has been appointed supervisory assistant of accounting and purchasing of the Latin America division, and will be stationed at Guatemala City, Guatemala.

District geologist appointments include John F. Harvey, from Salt Lake City, Utah, to Bogota, Columbia; David C. Harrell, from Jackson, Miss., to Caracas, Venezula; D. J. Munroe, from Tallahassee, Fla., to Guatemala City; and D. H. Cardwell, from Dallas to Havana, Cuba.

John A. Waller, formerly of Beaumont, has been appointed district geophysicist at Caracas.

Appointments as geologists include C. E. Lehecka, from San Antonio and McAllen, Texas, to Lima, Peru; John W. Harp, from Midland, Texas, to Guatemala City; and T. F. Ritter, from Evansville, Ind., to Havana.

Unitization for Rangely

Unitization of Colorado's Rangely field, largest oil producer among Rocky Mountain fields, is in progress. As a conservation measure, the entire field will be operated by one company. Rangely was discovered in 1934, but development did not begin until the war. It has produced 200 million barrels of oil, and rough estimates say another 175 million to 200 million remain to be produced under "primary" methods of recovery. The California Co., major operator at Rangely, will be unit operator.

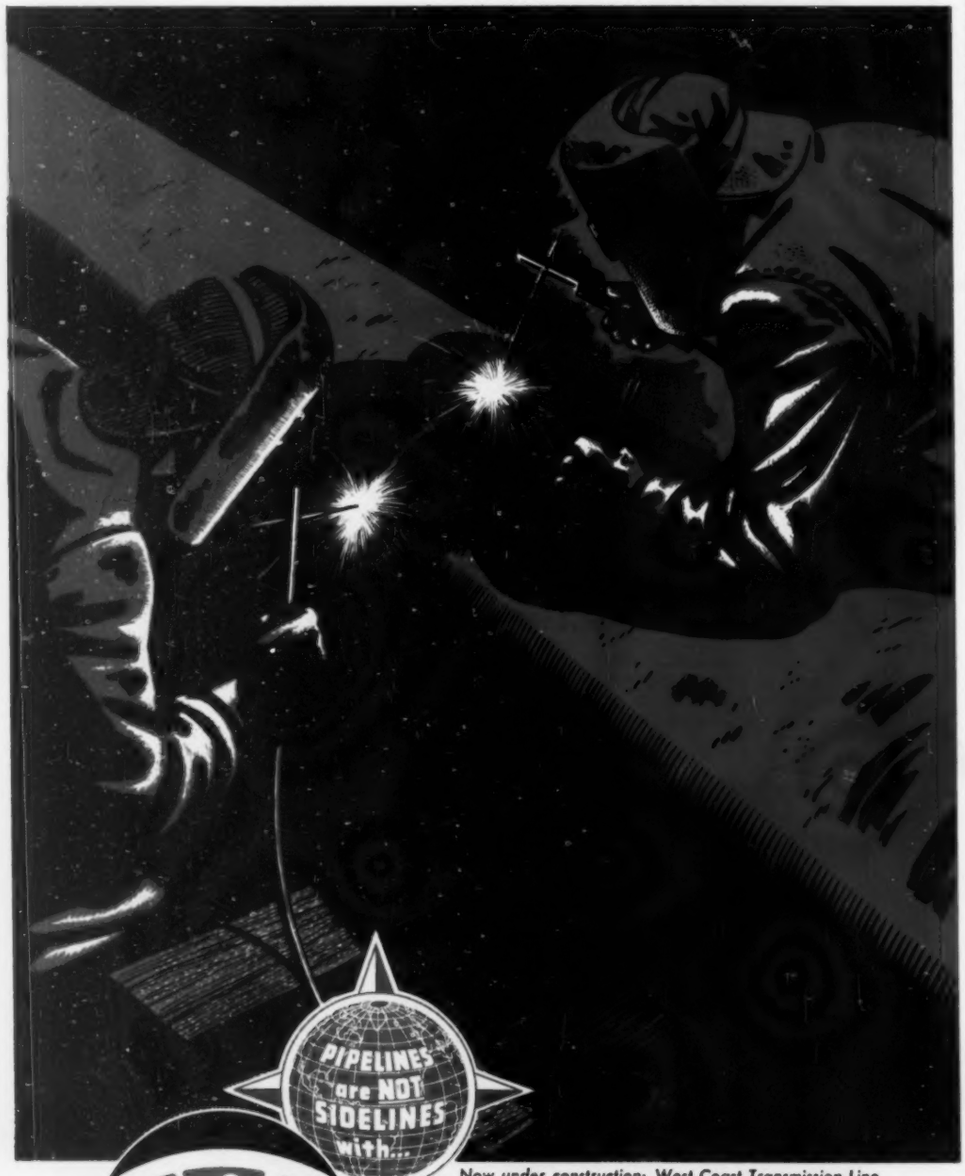
Indian Wildcat Suspended

High pressure at Sylhet No. 2 well has made further drilling temporarily inadvisable, Pakistan Petroleum Ltd. announced in Karachi. The well encountered natural gas below 4,000 ft, and was drilled to 9.245 ft.

Chemical Producers' Capital Outlays Increase 32%

American chemical producers planned to spend a record-breaking $853 million on new plant and equipment in the second half of 1956, establishing for the year a new annual high of $1.5 billion, according to the US Department of Commerce.

These capital outlays represent a 32% increase over actual expenditures in the first half.



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For information on any of the developments shown here, or for help on your specific engineering problems, write to Westinghouse Electric International Co., 40 Wall Street, New York 5, U.S.A.

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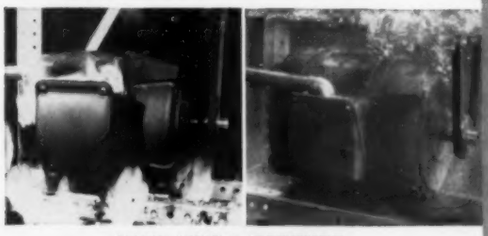

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Imagine a standard electric motor running for half an hour under the scorching heat of direct flames! Imagine a standard electric motor running continuously for two and one-half hours while completely submerged in water! These two spectacular tests, pictured above, recently demonstrated that Westinghouse Life-Line A Motors are by far your best buy for any application. For more information about Life-Line A Motors, request Booklet "C".

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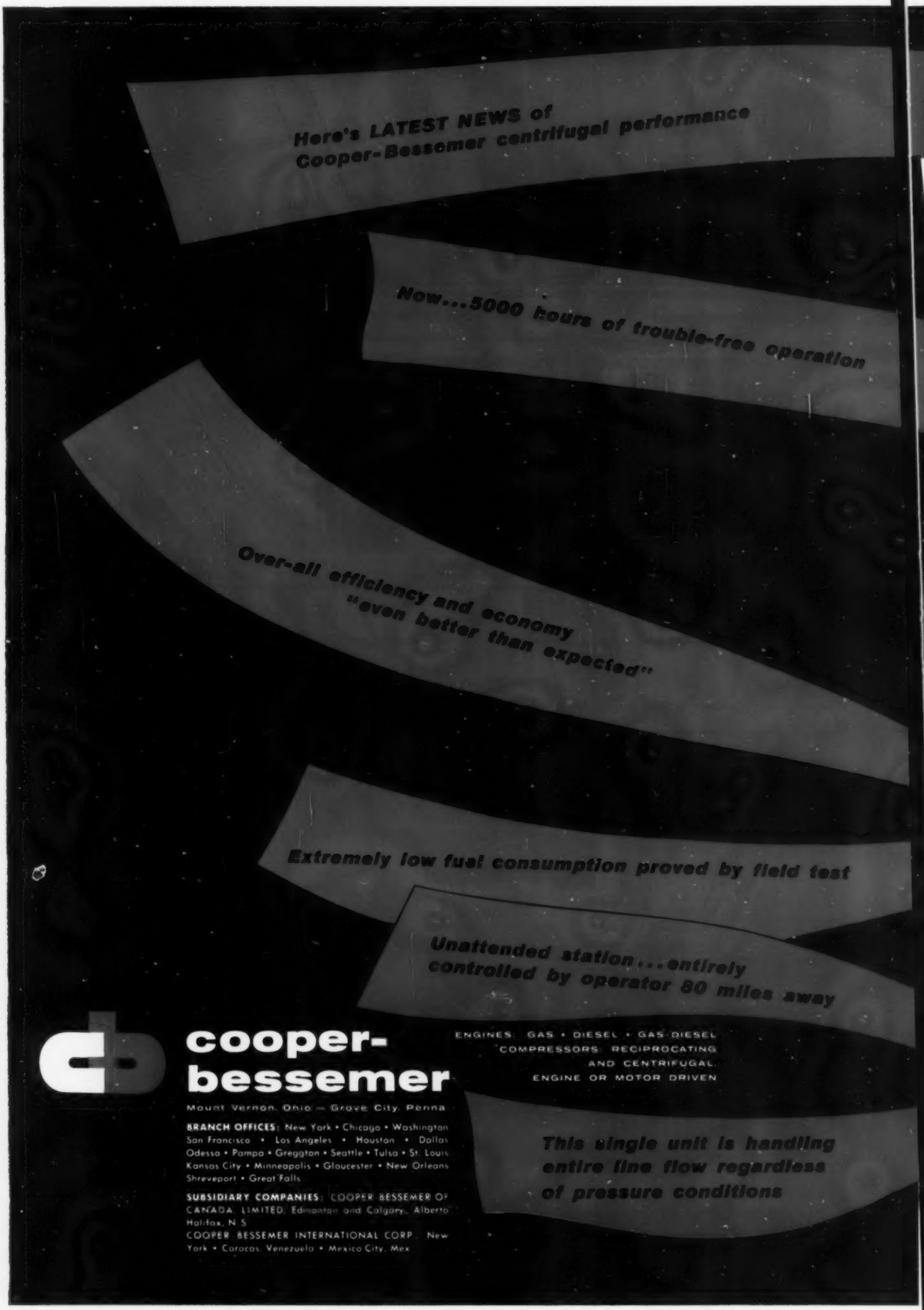
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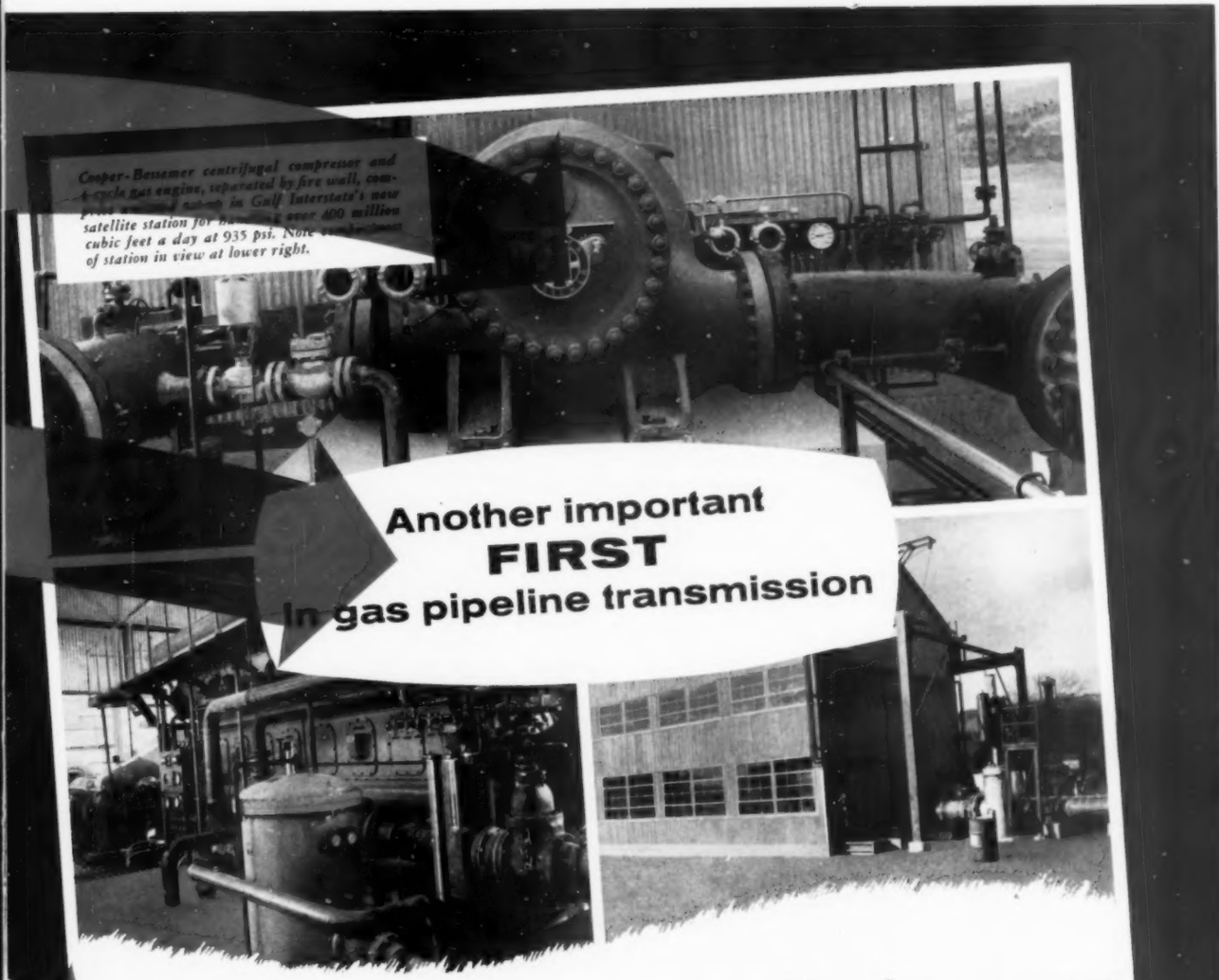

Cooper-Bessemer centrifugal compressor and 4-cycle gas engine, separated by fire wall, comprise unit at satellite station for Gulf Interstate's new 400 million cubic feet a day at 935 psi. Note ... of station in view at lower right.

Another important FIRST In gas pipeline transmission

Cooper-Bessemer ENGINE-DRIVEN *centrifugal* COMPRESSORS

● A new chapter in the progress of gas transmission has been opened at Gulf Interstate Gas Company's new compressor station near Stanton, Kentucky. Here, a Cooper-Bessemer engine-driven centrifugal compressor is the first such unit to go into regular service on a main gas transmission line.

This precedent is a tribute to Gulf Interstate management for alertness and decisive action in the application of promising new ideas . . . here successfully applied through the close cooperation of Gulf Interstate and Cooper-Bessemer engineering. These are a few of the highly significant features:

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Latin American Oil News

New Atlantic Well in Venezuela

Atlantic Refining Co. has started the drilling of a wildcat well in the Pedernales area of Venezuela. A depth of 2,700 ft has been reached, and drilling is projected to about 10,000 ft. The company will drill 2 wells in this area by which it will earn a half interest in a block of approximately 30,000 acres. Creole Petroleum Corp. has had production of heavy oil from shallow depths in this same area for several years.

Atlantic has also begun drilling of an offset to the recently completed Sinclair Aguasay No. 3 well in the state of Monagas, Venezuela. A depth of 6,300 ft has already been reached and, if projected to the same horizon as the Sinclair field, drilling will go to about 13,500 ft. Atlantic holds approximately 13,500 acres in this area jointly with Pancoastal Petroleum Co.

Prospects Uncertain For Private Investment In Chile

The proposed law to admit private oil companies to Chile faces an uncertain future.

Robert Eakens, counselor for economic affairs of the US Embassy, said the proposal went to the Congress "against a backdrop of commendable legislation affecting the copper and nitrate industries and an overall program designed to halt inflation and stabilize the economy.

"At the same time, its submission coincides with a pre-electoral period in which many complicating factors will be present," he said.

The Chilean executive sent to the Congress, late in November 1956, a bill to admit private capital to develop oil. But ENAP, the government monoply, would retain all of Chile, Tierra del Fuego, and a part of the province of Magallanes.

The proposed legislation allows oil companies a 15% depletion allowance, provides a one-eighth royalty which may be applied against taxes, and a tax of 50% on profits.

Uruguay Runs To Stills More 2 Million Barrels Quarterly

ANCAP, the government fuel monoply in Uruguay, reports crude-oil runs to stills during the third quarter of 1956 of 2,158,000 bbl.

Details follow:

Uruguay Refinery Production—3rd Quarter 1956
(Thousands of Barrels, ANCAP Refinery)

Crude runs to stills	2,158
Aviation gasoline	6
Motor fuel	509
Kerosine	354
Gas oil	177
Diesel oil	37
Fuel oil	1,017
Lubricants	0
Other	28
Gas	3
Losses	27

Exactly 5,781 bbl, i.e., 3,850 bbl of 73-octane; 1,572 of 80-octane; and 359 bbl of 91-octane.

Crude-oil imports to Uruguay came to 1,945,000 bbl from Venezuela and 121,000 bbl from Chile, for a total of 2,066,000.

Oil Companies Set New Gas Prices In Cuba

The sale of premium gasoline got under way in Cuba early in February under a new government decree. This substitutes for an earlier decree.

As sales started, oil-company officials estimated 20% of gasoline sales will be of premium—estimated to climb to one-third.

At start of sales, the price list for gasoline was:

Regular: .2825 (cents) to the retail dealer and .3200 (cents) to the consumer, for a dealer markup of .0375.

Premium: .3400 (cents) to the dealer and .3775 to the customer, for a markup of .0375.

Dealers had askked a markup of 15%, which would be .0420 in the case of regular and .0510 in the case of premium.

Peru's 1956 Crude Production Totaled 18½ Million Barrels

On the basis of 9 months actual, crude-oil production in Peru during 1956 is estimated at 18,500,000 bbl, higher than the 1955 total of 17,158,255. September production came to 54,266 b/d.

Details, by company, for each of three months follow:

Peruvian Crude Production, 3 Months 1956

	July	*August*	*September*
International Petroleum Co.	990,188	1,007,406	981,663
(b/d)	31,942	32,497	32,722
Compania Petrolera Lobitos	570,914	567,084	553,406
(b/d)	18,416	18,293	18,447
Empresa Petrolera Fiscal	66,296	64,720	71,569
(b/d)	2,139	2,088	2,386
Ganso Azul	17,366	19,320	21,339
(b/d)	560	623	711
Total crude oil	1,644,764	1,658,530	1,627,977
(b/d)	53,057	53,501	54,266

Natural-gasoline production, including propane and butane, came to 3,070 b/d during September. Details follow:

Peruvian Natural-Gasoline Production, 3 Months 1956

	July	*August*	*September*
International Petroleum Co.	71,453	75,240	75,664
(b/d)	2,305	2,427	2,523
Compania Petrolera Lobitos	14,837	14,925	15,287
(b/d)	479	481	510
Empresa Petrolera Fiscal	1,100	1,256	1,132
(b/d)	35	41	38
TOTAL	87,390	91,421	92,083
(b/d)	2,819	2,949	3,070

Crude-oil runs to stills, in total barrels for each of three months, follow:

Peruvian Runs to Stills, 3 Months 1956

	July	*August*	*September*
International Petroleum Co.	1,058,477	906,061	1,154,799
Ganso Azzul	19,612	22,277	26,333
Petrolera Peruana SH	9,768	9,768	9,768
Compania Petrolera Lobitos	269,824	269,824	261,120
Total	1,357,681	1,207,930	1,452,020

New Creole Foundation

The Creole Petroleum Corp. has decided to establish a foundation to support and encourage cultural, educational, and scientific activities in Venezuela, according to H. W. Haight, president. Mr. Haight said that the foundation, which is being established as a separate legal corporation with its own staff and board of directors, would be in operation before the end of 1956. Creole is prepared to provide it with a "substantial" operating budget during its first year of operation, as well as provide financially for its future activities on a long-term basis.

Mr. Haight said that the objectives of the new foundation will be similar to those of other organizations now carrying out such work in Venezuela under the sponsorship of private industry, individuals, or civic groups. Its programs might eventually include specific aid for education at various levels, viz., scholarships and fellowships; student-teacher exchanges; scientific research; training in such fields as art, music, literature, and medicine and nursing; the further development of agricultural training and research; youth training and organized recreational progams; the establishment of prizes and awards and other related activities designed to stimulate the arts and sciences. Mr. Haight emphasized that the foundation will utilize the intellectual resources of Venezuela in the development of its program. In this connection, its staff will seek the services of competent Venezuelan consultants from the educational, scientific, and cultural spheres throughout the country.

World Rotary Rigs Up 8%

During the last month of 1956 drilling around the world continued its increase, pushed up by the wave of independent companies searching for reserves. The total number of rigs operating reached 3,921 during last November, although the unsettled conditions in the Middle East opened some of the figures for that area to question. They are a small part of the total, however, and other reports indicate that the total rigs operating were up 8% from the last (August) report by *World Petroleum*.

A sharp gain occurred in the Western Hemisphere, where the exploration which is taking place has been stimulated by the Suez crisis. Venezuela continued to lead in total rigs, with 122 operating (excluding service wells), divided evenly between the Lake and Eastern and central parts of the country.

In Argentina Yacimientos Petroliferos Fiscales accounted for most of the drilling. Private companies, restricted for over 20 years to their existing holdings, are conducting little active exploration. The government's YPF seemed inadequate to the task of keeping ahead of Argentina's rapidly-expanding demand and privately increasing demands for admission of outside capital are being heard.

The total for Suoth America was up to 260 rigs, with Colombia having about 21 operating and Peru with nearly an equal number. Exploration in Bolivia was going forward with only four rigs, but is expected to rise sharply when new concession holders begin operations.

Central America had a total of 136 rigs operating, if Mexico is included. They included operations in Trinidad, where 27 rigs were running, Cuba, Haiti, and Costa Rica. One rig is operating in Panama, where Union Oil Co. is reportedly drilling an offset to Cocolas No. 1 & 2, in Costa Rica.

Rigs running in the United States totaled 2,766, by estimates for December 10, and Western Canada had 241 operating at the same time. Four rigs are known to be in Alaska, all have been counted but presumably weather has slowed operations during the peak of the cold season, now occurring.

In the Eastern Hemisphere some decline occurred when Suez was closed. Germany had 106 rigs working, the highest on the Continent, while second place was taken by Italy and Sicily. France had about 29 rigs going, stimulated by the search in the Paris Basin and Parentis area.

Africa is showing an increasing amount of activity. Rigs running are approaching the 50 mark, with the majority in Algeria where the Hessi Messaoud discovery in the Triassic appeared to be a good field. Morocco is also showing considerable activity, with about six rigs running. Shell is using six rigs in Nigeria, pushing the recent discovery there.

In Australia and the Far East results continue to be disappointing. Indonesia leads the countries with rigs active, having a total of 23 in late November, followed by Borneo with 15. India is currently using about six rigs. The rigs acquired from the Russians should be going into action soon.

WORLD-WIDE OPERATIONS by PARSONS

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London Letter

By E. Lawson Lomax

The petroleum industry in Great Britain ended 1956 with severe rationing and resultant developments. Rationing was accompanied by a heavy increase in the customs' duty on fuels for internal-combustion engines. Oil-industry members, as well as some in the public, definitely are dissatisfied with rationing—some regarding it as unnecessary.

Notification of coming rationing—a month ahead of time—is believed to have led to wholesale hoarding of motor gasoline. Stockpiling must have taken place, despite all regulations, as testified by depletion of service-station stocks. The basic gasoline ration, sufficient to run any vehicle 200 miles per month, is considered erroneous.

No allowance should have been given for pleasure motoring, nor for shopping, except where hardship could be proved; and priorities for fuel should have been solely for business and professional purposes such as public transport; goods deliveries; nurses and doctors; agents, representatives, and commercial travelers.

To meet inevitably rising costs resulting from the longer haul of Middle East crude around the cape, UK oil consumption must be reduced drastically without slackening of industry. Prior to the Suez crisis petroleum refining was on the rise because industry was converting to fuel oil—especially for projected new plants—due to rising coal prices and irregular deliveries. Oil companies were planning increased consumption and refinery expansion. Esso is to increase its refining capacity to 70,000 b/d—main objective: more residual fuel oil. In addition to a new tanker terminal at Milford Haven, it is to build a new refinery. British Petroleum is increasing capacity of its Kent refinery with a new 90,000 b/d atmospheric distillation unit and facilities. A new 80,000 b/d crude distillation unit increases Shell's refinery capacity at Shell Haven. Regent Oil Co. plans a new 100,000 b/d plant at Hook on Southampton Water. Caltex, Esso, Shell Mex, and BP earlier announced a joint 30,000 b/d to 40,000 b/d refinery in Ireland. These planned extensions also envision supply of refinery gas to local gas companies which formerly relied almost exclusively on coal. Extensions during 1956 were made to most of the petrochemical plants—many of them now turning out products previously obtainable only from the USA. Future range of products, including synthetic rubber, will be more extensive.

Manufacture of 100-octane gasoline, started in June by the major companies, will cease until after discontinuance of rationing. Impact on oil companies with these new facilities is reflected by their materials' orders which, in the first 9 months of 1956, totaled £114,171,040, compared with some £93 million for same period in 1955.

A notable event of the year was the controversy engendered by sale of Trinidad Oil Co. interests (formerly Trinidad Leaseholds Ltd.) to The Texas Co. In November it was announced BP had purchased all the stock of Trinidad Petroleum Co. Ltd., control of which previously had been sought by Colorado Gas and Oil.

Tanker owners appear pessimistic as to the future value of the Suez Canal, especially for northbound vessels. At nationalization, plans for increasing "laden" draft to 36 ft in 2 years (from former 34½ ft) would have accommodated 40- to 45,000-dwt tankers. Recently orders for such vessels have been cancelled and replaced by those for 65- to 80,000 dwt—with increased speed. British Tanker Co. recently launched one with a trial speed of 18 knots. Though few present UK refinery locations could accommodate such large tankers, provisions therefor are planned. Loading and unloading mammoth tankers requires deep-water facilities. Some refineries, such as those at Fawley, Shell Haven, and Kent, are favorably located; others are not. Esso and BP have bought land at Milford Haven, probably UK's finest deep-water harbor. The former plans a refinery and deep-water jetties for any proposed tanker; and the latter, deep-water jetties—with pipeline connection to its Llandarcy refinery. BP's Grangemouth refinery—with pipeline connection to its Loch Finnart ocean terminal—by jetty extension can accommodate a tanker of any projected size. Present jetties on the Medway and Thames can be dredged for larger tankers, as well as at Fawley and Southampton Water. A new terminal, with pipeline connection to Tranmere on the Mersey, is planned for Shell's Stanlow refinery.

The present UK oil crisis presages increase in nuclear electric-power stations. Three Calder-Hall-type stations are to be built immediately, with total capacity of 850 megawatts.

A change which should increase efficiency of road transport was the raising, in November, of the speed limit of heavy-goods vehicles to 30 mph, from fomer 20 mph.

Scottish Gas Board is about to test the pressure decline in the natural-gas field at Cousland (near Edinburgh) discovered prewar by BP—before further drilling proceeds. Closed-in wellhead pressure is now 600 psi. Possible annual take from the field may have a heat equivalent of 5,000 tons of coal.

New Shell Film

Worldwide locust control is covered by a new film, "The Ruthless One," in Shell's insect-control series.

Liquid Oxygen Factory

A liquid-oxygen plant has been opened by British Oxygen Co. at Brimsworth—to be followed by plants for oxygen compression, dissolved acetylene, and nitrous oxide.

Shell Turbine Use

Shell has ordered 9 gas turbines—total capacity, 46,900 kw—for use in its gas fields with available natural gas and limited water supplies.

In 1956 five units were ordered: a Metropolitan-Vickers 4,300-kw and an American Westinghouse 4,840-kw set for oil-field power at Seria oil field (British Borneo); a 20,000-kw Swiss Brown-Boveri set for Las Moro (Venezuela); and two 2,000kw English Electric Co. sets—one for Casabe (Columbia), the other for a Lutong refinery (Sarawak).

British Synthetic Rubber Plant

International Synthetic Rubber Co. (Dunlop, Goodyear, Firestone, and Michelin ownership) will have a £4 million 50,000-ton-per-year synthetic-rubber plant near Fawley refinery. Matthew Hall & Co. is contractor; Blair-Knox (Pittsburgh, USA) subcontractor.

Tanker News

Largest oil cargo ever to dock at a UK port was the 52,600 tons of Kuwait crude, around the cape, delivered to Fawley refinery late in December. Diverted from delivery to Philadelphia (USA), this Middle East crude was carried in the "Sinclair Petrolore." Recently the 47.122 dwt "Soyros Niarchos" went from the Persian Gulf around the cape to Marseilles in 27 days, 17 hours, 48 minutes, at average speed of 17.34 knots. To date tankers delivering ME crude to UK ports either had been out in the Persian Gulf or diverted there, and none has yet made the complete journey around the cape since the Suez crisis. Until such roundtrips get going, no estimate is possible of oil quantities which can be brought to UK via this route.

December tanker launchings included the 17,500 dwt MV "Angelos Lusis" at Greenock yards of Scotts' Shipbuilding—owners, Sociedad de Carga Oceanica SA, Panama; the 18,200 dwt SS "Virginia" at Haverton Hill yards of Turners Shipbuilding—owners, Nueva Vista Compania Naviera SA, Panama; the 32,000 dwt 18-knot "British Valour" at Swan yards of Hunter, and Wigham Richardson—owners, British Tankers Ltd.; the 16,000 dwt MV "British Vigilance" at Sir James Laing & Sons yards—owners, British Tankers.

Personnel

R. T. Campbell is now general manager, at London, of Mobil Oil Co.'s industrial divisions.

Jean Ornstein, deputy chairman and managing director of BP Benzin and Petroleum Co., in Germany, is presented with an award as an honorary commander of the Order of the British Empire (CBE) for his service to the British community in Germany. Left is Sir Frederick Hover Millar presenting the award.

Mr. Ornstein, who is French, has had 44 years' service with the oil industry—most of it with The British Petroleum group in France and Germany. After World War II he became BP's representative in Germany, and managing director of the German company.

W. C. Townsend, a director of Caltex Trading & Transport Co., has been elected to the board of Overseas Tankship (UK), agents for the former company; F. S. Garbett succeeds Mr. Townsend as secretary of Overseas Tankship.

Luke Fraser, as of the first of 1957, is London manager for G. & J. Weir. Mr. Fraser will be succeeded (for Scottish sales) by Forrest T. Randell, from Cardiff. A. C. Smith has returned to Glasgow, head office, as sales director.

John Spiers has been appointed senior experimental engineer for F. Perkins Ltd., Peterborough.

Brian S. Page has been appointed head of a new special oil export sales department for Ruston & Hornsby Ltd.—his title, assistant export sales manager (oil fields).

E. J. Sturgess, at the New Year, was appointed a Commander of the British Empire (CBE). He is Shell's chief engineer. Awarded the British Empire Medal (civil division) is Frederick B. Lovett, shipping foreman for Mobil Oil Co.

Trinidad Net Up

Effective January 1, 1957, F. P. Barribal (MBE) and J. A. Paul are directors of Mobil Oil Co. Ltd.

Gross profits for the year ended 1956 of Apex (Trinidad) Oilfields Ltd. was £616,845; net after taxes and other deductions, £262,667. Comparable 1955 figures are £683,804 and £260,822. Total 1957 dividend is 1 s. 9 d. per 5-d unit.

National Benzole Sale

Shell-Mex and BP Ltd. have offered to purchase motor-fuel and lubricants marketing holdings of National Benzole Co. Ltd. Latter has not yet accepted, but is expected to.

Shell Net Up

Net income for January-September 1956 of Royal Dutch Petroleum Co. Ltd. was £132,208,000 (1955, £113,459,000). Interim dividend declared for financial year is 1.50 florins per share of 20 gilders par value.

British Malayan Registers Under New Act

The British-protected state of Brunei introduced a companies registration enactment for the first time, effective January 1, 1957; two days later The British Malayan Petroleum Co. Ltd., the Shell group associate which operates in Brunei, announced that a company called Brunei Shell Petroleum Co. Ltd. had been registered under the new enactment to acquire and carry on the business previously conducted by BMP. The changeover will take about two months. The same board of directors will officiate.

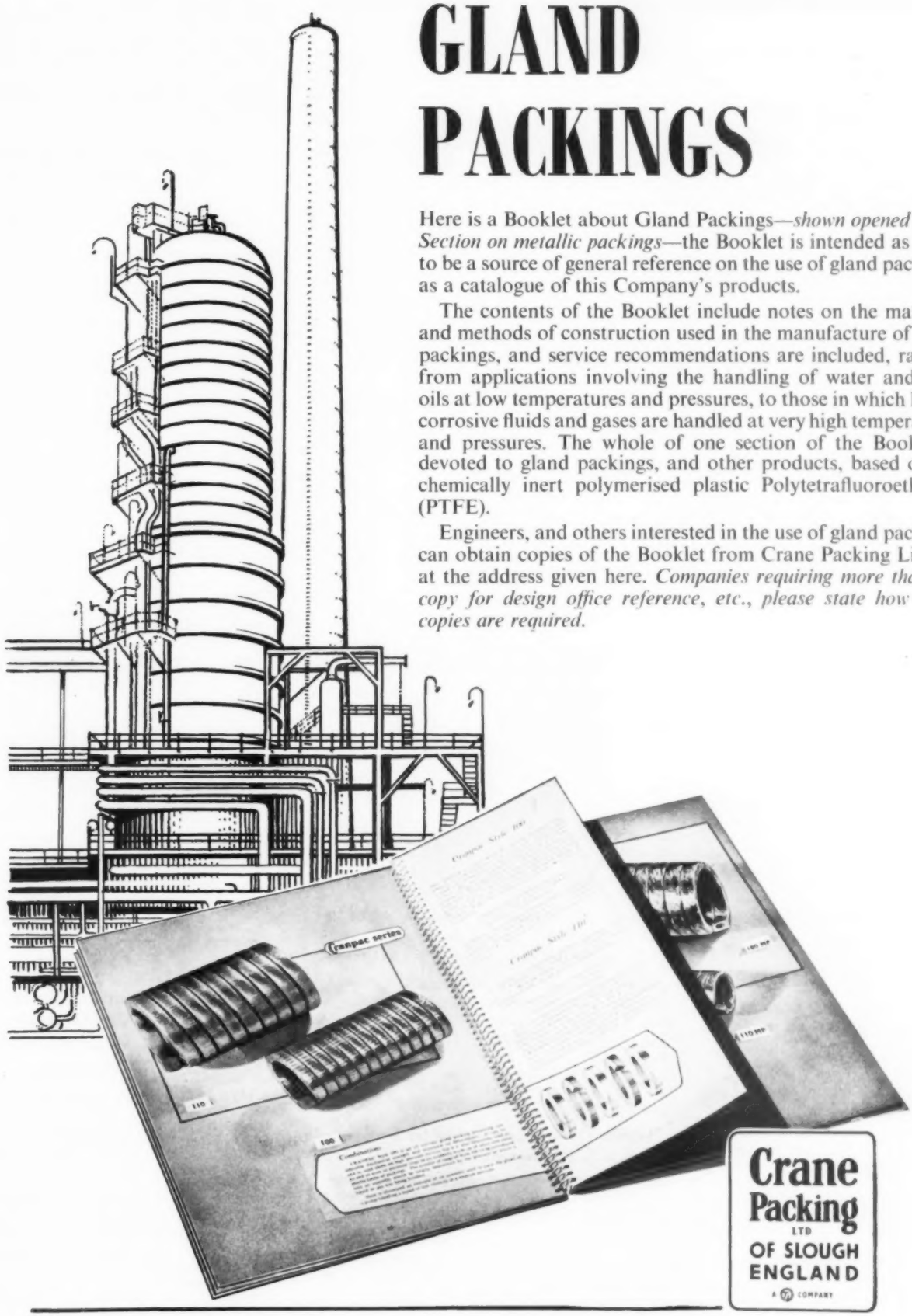
The BMP Co. first was registered in 1922, with headquarters in London, to search for and exploit oil in Brunei. Seria field was discovered in 1929, although development on a large scale did not begin until the early 1930's. END

GLAND PACKINGS

Here is a Booklet about Gland Packings—*shown opened at the Section on metallic packings*—the Booklet is intended as much to be a source of general reference on the use of gland packings, as a catalogue of this Company's products.

The contents of the Booklet include notes on the materials and methods of construction used in the manufacture of gland packings, and service recommendations are included, ranging from applications involving the handling of water and light oils at low temperatures and pressures, to those in which highly corrosive fluids and gases are handled at very high temperatures and pressures. The whole of one section of the Booklet is devoted to gland packings, and other products, based on the chemically inert polymerised plastic Polytetrafluoroethylene (PTFE).

Engineers, and others interested in the use of gland packings, can obtain copies of the Booklet from Crane Packing Limited at the address given here. *Companies requiring more than one copy for design office reference, etc., please state how many copies are required.*



International News and Notes

Tanker Terminals for 100,000 Dwt "Super-Supers"

British petroleum companies are studying plans for development of tanker terminals capable of accommodating tankers of 100,000 dwt, i.e., the largest envisaged at present. Terminals are to be built at Milford Haven by British Petroleum Co., together with a 60-mile buried pipeline to its Llandarcy refinery. In the same location, at Angle Bay, Esso Petroleum Co. proposes a new terminal with accommodations for the largest tankers and also a new refinery.

Oil for Shell's Stanlow refinery is at present discharged from tankers at Eastham dock at the entrance of the Manchester ship canal, but this terminal will not accommodate tankers over 33,000 dwt; so a new terminal is to be built at Transmere on the Mersey, where 40 ft of water at low tide is available. Transmere terminal will be connected with Stanlow by pipeline.

British Petroleum Co.'s refinery at Grangemouth is connected by pipeline to Loch Finnart, where there is a jetty capable of taking up to 35-ft draft, i.e., about 40,000 dwt. Plans are being discussed for a new jetty at this location—farther into the loch—where 55 ft of water is available at low tide. There are jetties in the Thames and Medway which, with little dredging, will take 60,000 dwt tankers. At present no plans for building jetties to accommodate larger tankers are in hand.

At Southampton, dredging of the approach channel would allow 60,000 dwt tankers to berth at Fawley; but, when the new Caltex refinery is built at Hook, opposite Fawley, Southampton Water—which is used by the largest passenger liners—it may become very congested, and it may not be possible to arrange jetties for the berthing of 100,000 dwt tankers. On December 20 the "Sinclair Petrolore," loaded with 52,000 tons of Kuwait crude, was to berth at Fawley. She is 789 ft long, and has a 40-ft draft.

Crude Line to Mediterranean Across Tunisia

A crude-oil pipeline crossing Tunisia to the Mediterranean is under study, according to Esso Standard Oil Co. in Tunisia.

Compagnie Française des Pétroles is studying this in the wake of discovery of commercial quantities of crude oil south of Tunisia on the Algerian-Libyan frontier.

One route for the line would be to Tripoli (shortest). But this is receiving less favor than routes to Gabes, which is slightly longer, and to Bone, which is twice as long as to Tripoli.

Suez Crisis Delays Iraq Refinery

A delay until June is foreseen for completion of a lubricating-oil refinery at Baghdad, Iraq. The plant was to have been completed in April.

Officials say the chief reason is delay in arrival of equipment due to rerouting of ships which were to go through the Suez Canal.

Kuwait Exported 350 Million Barrels Crude in 10 Months

Crude-oil exports from Kuwait in October 1956, just before Suez Canal closure, were a record 37,183,554 bbl. Total for the first 10 months of the year was 349,244,216 bbl.

Distillate exports came to 736,666 bbl for the first 10 months.

Exports of crude from the Neutral Zone in October came to 584,569 bbl (from Aminoil), or 4,817,522 for first 10 months.

Exports by Getty Oil Co. totaled 685,849 bbl in October, and 5,160,406 for first 10 months.

The exports from Kuwait proper, by Kuwait Oil Co., went to these destinations:

	October 1956 (Barrels)	*Year 1956 (Barrels)*
USA	5,667,276	50,421,353
United Kingdom	10,111,009	102,487,497
France	5,374,818	48,697,518
Italy	2,779,536	25,744,508
Holland	3,228,561	31,864,299
Aden	2,639,234	27,028,360
Australia	1,122,161	14,630,733
Brazil	822,746	8,499,718
Argentina	1,105,497	9,679,304
Belgium	—	2,779,563
Canary Islands	—	2,606,048
India	—	4,258,590
Other	4,332,716	20,546,725
Total	37,183,554	349,244,216

Destination of crude from Aminoil and Getty follow:

AMINOIL	*October*	*Year 1956*
USA	—	243,971
Japan	518,907	3,139,764
Italy	65,662	1,433,787
	584,569	4,817,522

GETTY	*October*	*Year 1956*
USA	585,755	2,662,538
Japan	100,094	910,657
France	—	1,587,211
	685,849	5,160,406

Lebanese Refineries Export 2½ Million Barrels to Syria

Oil refineries in Lebanon are reported to have exported 3,861,144 bbl of petroleum products in 1955, of which 2,453,274 bbl went to Syria.

A recent breakdown for two refineries follows:

TRIPOLI
Iraq Petroleum Co.

	Syria	*Other*	
Gasoline	479,932	200,601	
Kerosine	221,053	105,135	
Gas oil	432,783	92,040	
Fuel oil	785,884	3,592	
Total	1,918,652	401,366	2,320,018

SIDON
Mediterranean Refinery Co.

Gasoline	142,952	71,995	
Kerosine	92,036	36,690	
Gas oil	58,839	14,038	
Fuel oil	240,795	901,420	
	—	52,924	
Total	534,622	1,006,504	1,541,126
Grand Total	2,453,274	1,407,870	3,861,144

USSR Technicians to Assist Indian Oil Development

The first group of 174 Soviet petroleum technicians was due to arrive in India during December as India's "second plan" for crude-oil development gets under way.

Some 26 Soviet technicians were due in India to carry on exploration and development in the Punjab and Uttar Pradesk. Some 1.4 million rupees is being spent by India for this bite of the Soviet-Indian cooperation.

The "second plan," meanwhile, is estimated to cost India 300 million rupees for petroleum exploration; a goal is to reach 7 million tons a year of oil production. Standard Vacuum Oil Co., meanwhile, is to start drilling in West Bengal early in 1957.

Dresser's 1956 Sales Set Record

Dresser Industries Inc. enjoyed record sales and earnings for the fiscal year ended October 31, 1956, it is announced by H. N. Mallon, chairman. Preliminary, unaudited results indicate net earnings of about $17.3 million on sales of approximately $230 million, by comparison with net earnings of $10.9 million on sales of $170.8 million for the previous year. Sales and earnings for both years indicate earnings per share for 1956 were about $7.95, by comparison with $5.02 earned for 1955. Sales were up 35% and earnings up 60%.

Iraq Monthly Crude Production Totals 3 Million Tons

Crude-oil production for Iraq approximated more than 3,000,000 long tons in each of August and September 1956.

Net production and net exports, by months and fields, follow:

IRAQ
CRUDE-OIL PRODUCTION AND EXPORT
(Long Tons)

August	*Net Production*	*Net Exports*
Kirkuk (IPC)	2,200,533	2,092,318
Zubair and Rumaila (BPC)	723,446	710,406
Ain Zala of Butmah (MPC)	113,253	113,252
Quaiyara (MPC)	3,185	—
Khanaqih (NOC)	15,568	—
Total	3,055,985	2,915,976
September		
Kirkuk	2,148,895	2,045,025
Zubair and Rumaila	810,347	798,514
Ain Zala of Butmah	106,974	106,974
Quaiyara	6,348	—
Khanagin	18,393	—
	3,090,957	2,950,513

IPC and Tapline Accept Daily 1½ Million Barrels of Crude

Receipts through September 1956 of crude oil from 2 of the big pipelines in the Middle East, i.e., Iraq Petroleum Co., to Tripoli, and Arabian-American Oil Co., to Sidon, in barrels per day, by each for 3 quarters of 1956, follow:

First Quarter:	
153,987	At Tripoli from IPC
318,068	At Sidon from Tapline
472,055	

Second Quarter:	Third Quarter:
158,754	165,142
332,604	335,946
491,358	501,088

Estimate 1957 Tunisian Consumption At 2,856,000 Barrels

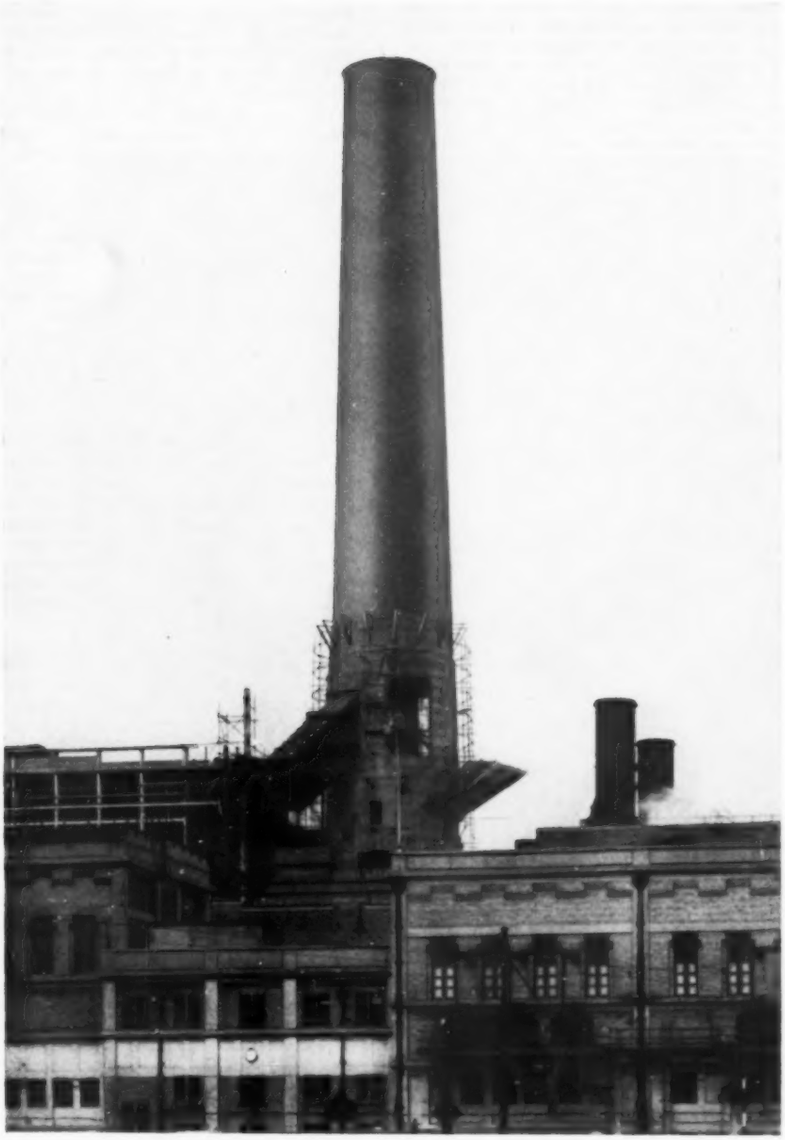
USA oil companies estimate Tunisia will consume 2,856,000 bbl of petroleum products during 1957. They estimate the cost (CIF in Tunisian ports), on the basis of the present price structures, at US $12,850,000.

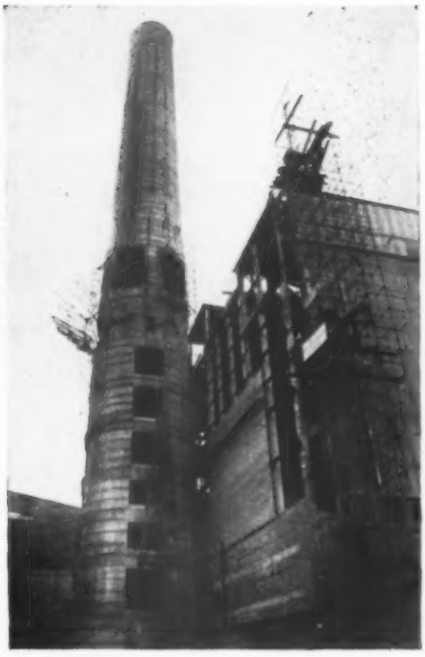
Details follow:

Estimated Tunisian Consumption in 1957

Product	*Barrels*	*CIF in Tunisian Ports*
Gasoline	711,000	$3,800,000
Kerosine	270,000	1,500,000
Gas oil and diesel oil	722,000	3,750,000
Fuel oil	1,152,000	3,800,000
(light and heavy)	—	—
Total	2,856,000	12,850,000

Tahar Amira, director of the Service des Mines of Tunisia, has been seeking petroleum products from US firms and elsewhere, as France decided to cut supplies to the country by 30% in the wake of the Suez Canal closing.





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Jersey Standard to Build 40,000 B/D Refinery in Norway

The Norwegian government and Standard Oil Co. (N. J.) have reached an agreement in principle for the construction of a petroleum refinery in Norway —larger than any existing in Scandinavia. It will be operated by a newly formed Norwegian company fully owned by Jersey Standard.

Construction is to start in 1958, on the Oslo Fjord. The refinery will be designed to process approximately 40,000 b/d of crude oil from Middle East sources. Its production will be sufficient when operation begins (probably in 1960) to meet all the major product requirements of Norske Esso, a Jersey Standard affiliate, and to export substantial quantities to Esso marketers principally in Sweden or Denmark, or both.

Construction is estimated to cost approximately $29,000,000, of which 60% will be supplied in dollar capital and loans.

The principal products will be gasoline, jet fuel and kerosine. LPGas, automotive diesel fuel, other distillate fuels, and fuel oils. The principal units of refinery equipment will provide for crude distillation, naphtha reforming, stabilization and sweetening, kerosine treating, and diesel-fuel finishing operations. Auxiliary facilities will include steam generation, storage tanks, and shipping berths.

Jersey Standard's plan for a new Norwegian refinery is consistent with the company's policy of increasing refining capacity in western Europe to meet the needs of expanding markets. Since 1945 Jersey affiliates have added major new refining facilities in England, Belgium, France, Germany, and Italy, and substantial capital expenditures on refining facilities are now being contemplated in England, France, Germany, and Holland.

The only other refinery in Norway is one owned by Norske Esso at Vallo—small and specialized, designed primarily to produce lubricating oils and asphalt, which will not be manufactured at the new refinery designed to meet major fuel needs.

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US Leadership from Ample Domestic Oil

Disruption of Middle East oil shipments may increase demand for US crude oil by as much as 800,000 b/d during the coming 6 months, according to Minor S. Jameson, IPAA economist, who recently reported to a meeting of the Independent Petroleum Assn. of America on the outlook for US oil production.

This would result from probable shipments of 500,000 b/d to oil-short western Europe and an estimated 300,000-bbl reduction in oil imports to the United States.

However, assuming improved conditions in the Middle East, he estimated 1,300,000 b/d of Middle East oil may be shipped to Europe in the first 6 months of 1957. This would include 750,000 b/d by tanker around the Cape of Good Hope, 350,000 b/d by pipeline from Saudi Arabia, and 200,000 b/d by pipeline from Iraq or through Suez.

He estimated as much as 1,200,000 b/d may be shipped to Europe from Western Hemisphere sources in the first half of 1957. This would include 700,000 b/d from the Caribbean area and 500,000 b/d from the United States.

"This total shipment (to Europe) of roughly 2,500,000 b/d would represent 85% of the total oil shipped to Europe and Africa prior to the disruption of transportation facilities in the Middle East."

In addition to increased US oil exports, elimination of Middle East oil shipments to the Western Hemisphere and stepped-up shipments from the Caribbean area to Europe, "should reduce planned imports into the USA by 300,000 b/d or more," said Mr. Jameson.

"The increase in exports and decrease in planned imports, therefore, may increase the demand for domestic crude oil in the range of 7,800,000 b/d to 7,900,000 b/d during the coming 6 months as compared with the pre-Suez outlook of 7,100,000 b/d," he said. The uncertainty as to future developments, including changes in oil tanker movements, makes this outlook "subject to review and revision as circumstances change." For example, he said, a tanker capable of moving 2,230 b/d of oil from the Persion Gulf to England through Suez could move an average of only 1,300 b/d around the Cape of Good Hope.

Mr. Jameson commented that excessive oil imports into the US prior to the Suez dispute had "limited (development of) domestic transportation facilities from areas of production within the United States." He also warned that the buildup of tanker capacity to compensate for the interruption of Middle East transportation facilities, when the present situation is resolved, will "increase greatly the pressure to import oil into the US., emphasizing the need for policies to assure ample availability of domestic oil for the future."

New Oil Find in Nigeria

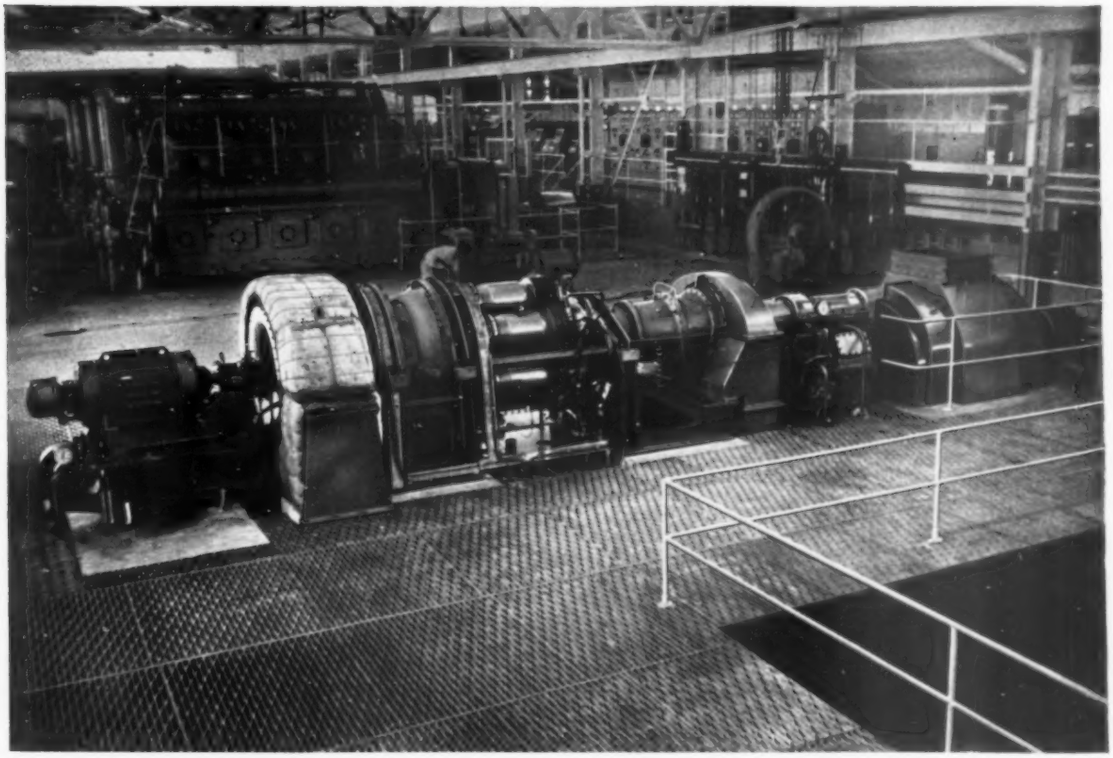
An exploration well near Afam, 20 miles east of Port Harcourt, Nigeria, has encountered oil and gas during the first stages of testing. Up to now, only the lowest prospective sand layer in the well has been tested. A second well is now being prepared, about three-quarters of a mile north, which will be drilled on completion of testing in the first if results continue to be encouraging. Exploration is by British Petroleum Co. and Royal Dutch-Shell group.

Medium Hp Turbocharger

After five years of research and field tests, engineers at Worthington Corp. have produced a new turbocharged gas-engine compressor known as the SLHC. Available in the medium horsepower range (330-880 hp), it is the only gas-engine compressor in its class size which has been turbocharged. The SLHC gas-engine compressor is designed for pipeline distribution service; in natural-gasoline plants; for pressure maintenance in oil fields; for oil refinery operations; for refrigeration systems; and in the petrochemical industry.

Five SLHC sizes are available in 4, 5, 6, 8, and 10 power cylinder combinations—in in-line design. Higher ratings will be offered where the turbocharging air can be after-cooled by water colder than can be provided by a radiator. This is possible in many permanent plant installations.

Gas Turbines for the Oil Industry



The photograph shows a Metropolitan-Vickers 1,750 kW gas turbine-generator set supplied to the Campania Shell de Venezuela Limited and installed for operation on natural gas at La Concepción, Venezuela.

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OOG Reports on US Ability to Deliver Crude Oil

Department of the Interior's Oil and Gas Division, reporting on a comprehensive study of an industry group, has revealed the ability of the US to deliver crude oil to the Gulf Coast. Net effective pipeline capacity to the Gulf Coast in July of 1955 was 3,233,000 b/d; crude-oil movements were 2,633,000 b/d; spare capacity was 600,000 b/d. Comparable figures for December 1956 are: capacity, 3,295,000 b/d; flow, 2,910,000 b/d; spare capacity, 385,000 b/d.

The comparable figures for December 1956 are:

Capacity	3,295,000 b/d
Flow	2,910,000
Spare	385,000

Spare capacity in pipelines to the Gulf Coast (in thousands of barrels per day) are:

	July 1956	*November, 15 1956*	*December, as based on November 15 plans*
Texas Railroad Commission Districts 2, 3, 4, (Gulf Coast)	314	273	210
Texas Railroad Commission Districts 5 and 6 (East Texas)	104	102	97
Texas Railroad Commission Districts 7 and 8	81	2	20
Louisiana	95	65	53
Alabama-Mississippi	6	5	5
Totals	600	447	385

The OOG said the crude-oil throughput at Texas and Louisiana Gulf Coast refineries in July was 2,657,000 b/d. For November 9, it was given as 2,611,000 about the same.

Pipeline runs of crude to the Gulf Coast were 2,633,000 b/d in July and 2,806,000 as of November 15.

The OOG said the study was made to answer this question of OOG: How much more crude oil, over the July levels, can be delivered to the Gulf Coast?

The answers were these:

(1) An extra 600,000 b/d by stepping up the flow.

(2) Another 150,000 b/d by using tank cars. But this would call for government direction and government reimbursement of excess costs, as well as more loading racks.

(3) Another 240,000 b/d could be made available if crude were shipped to the Wood River-Chicago-Lima area and carried by tank car to the East Coast. This, too, would call for emergency actions as in point (2).

(4) Still another 110,000 b/d could be made available by use of barges, railroads, and trucks to the Gulf Coast. This adds up, in total, to 1,100,000 b/d extra.

The OOG said stocks of crude and condensate on the Gulf Coast as of September 30 added up to 49,300,000 bbl aboveground. Some 10,250,000 of these could be drawn upon to meet the new demand from Europe.

The 49,300,000 bbl is exclusive of line fill and lease stocks.

Thomas A. Edison, of Creole Petroleum Corp., reporting on the operation of the "Tia Juana No. 1 Conservation Plant" in Venezuela's Bolivar coastal field, said its history shows that an additional 2½ million barrels of oil and 100 billion cubic feet of gas have been made available since the project began in 1954. He anticipated an ultimate recovery 43% greater than if the reservoir had been allowed to produce by natural depletion without gas injection.

Dr. G. Thery Fombona, director of mines and hydrocarbons in Caracas, reported 21 gas-injection and 9 water-injection plants have provided an additional recovery of 358 million barrels of oil. Projects now under construction or under study may provide another 406 million barrels of additional recovery.

Denver petroleum consultant Maury M. Travis said the critical situation affecting western Europe due to Suez Canal blocking suggests that, in the interest of national security, a sober integrated viewpoint should prevail so as to permit the greatest incentive for future oil and gas exploration in the US without sacrificing the true interest of either independents or major producers—through cooperation, not domination, by government.

New UOP Market Research and Economics Service

Universal Oil Products Co. has established a market research and economics department to help industry 'think out" problems of plant expansion, modernization, and new refineries, under direction of M.D. Gilchrist, vice president.

The department is a result of increasing complexity of oil and petrochemical marketing problems. Named to head the department is Samuel W. Curry, petroleum economics specialist with six years' experience in UOP sales and marketing posts.

Functions of the department include marketing studies of projected demand for any refinery product, analysis of economic potential of processes and equipment, and estimates of future price and production trends. Financial studies of the value of existing refineries—essential to independent refiners who require outside financing for expansion programs—also are made by the department.

Universal's expansion into marketing and economics evaluation rounds out the pioneer petroleum process development organization's activities into a full line of services from basic research and development, refinery design and construction to advice on which products offer the greatest potential.

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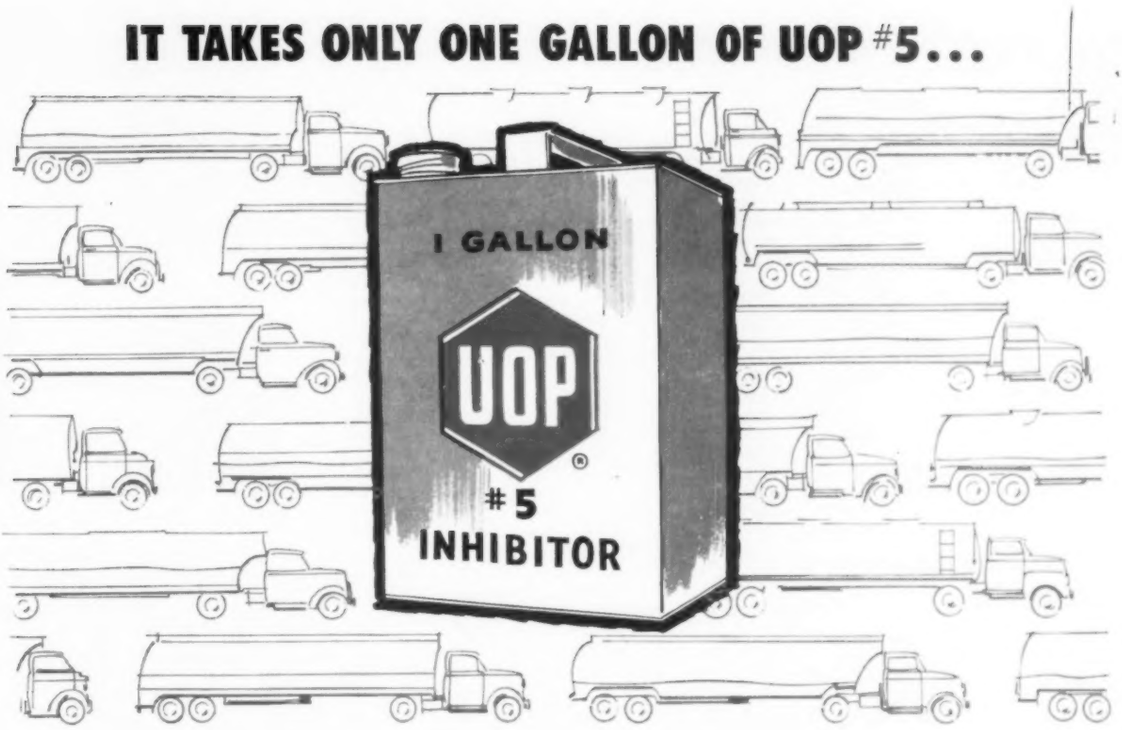

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Just as the methods of making better gasoline keep changing, so do the techniques of finishing gasoline for maximum gum stability and engine cleanliness. We will be glad to share our experience in this field with you in attacking a current stability problem or in reducing costs on present processing. Just write us.

PRODUCTS DEPARTMENT

UOP **UNIVERSAL OIL PRODUCTS COMPANY**

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Mexican Crude and Refinery Operations Up in August

Mexican crude petroleum production reached 252,600 b/d during August 1956, according to reports from the Ministry of Economy.

This compared with June's 249,900 b/d and July's 247,700 b/d.

The figures on production by natural distillates, heavy crude, and light crude are:

CRUDE-OIL PRODUCTION
(Cubic Meters)

	June	*July*	*August*
Natural distillate	2,926	2,895	3,332
Heavy crude	180,190	184,708	188,945
Light crude	1,008,807	1,030,068	1,052,432
	1,191,923	1,217,671	1,244,709

Mexican refinery production came to 1,639,902 cubic meters in August, compared with June's 1,130,345 and July's 1,541,718. Details follow:

	June	*July*	*August*
Fuel oil	528,279	696,246	740,021
Gas oil	76,892	111,098	120,984
Crude gasoline	159,611	219,476	222,601
Refined gasoline	179,212	218,725	240,236
Crude kerosine	83,937	104,552	102,848
Refined kerosine	54,356	65,967	73,268
Lubricants	584	55,984	69,191
Crude paraffin	—	4,638	4,573
Refined paraffin	964	872	688
Asphalt	6,242	5,342	10,508
Other	—	—	—
Gas	25,506	25,843	29,348
Total	1,130,345	1,541,718	1,639,902

New Russian Process

Cracking by nuclear energy has been developed by the Azerbaidjan Inst. for Scientific Research in Oil Refining, according to the official Soviet news agency TASS.

The report said the new process is working at normal atmospheric pressure and temperature, but uses no catalyst.

Another Soviet report said that the Kirov Machine Tool Building Plant in Tbilisi (Georgia SSR) has completed work on a special T-46 lathe for turning, boring, and threading drill bits. Advantages are claimed over corresponding American equipment which uses two lathes, according to TASS.

Underground Oil Storage in Sweden

A new type of underground oil storage in Sweden known as the "Viaco Cistern" involves the use of old mines or specially blasted rock chambers. The oil rests on an adjustable bed of water and is prevented from leaking away by the pressure of the water in the surrounding subsoil. The system has been patented in several countries. A $5 million expansion program is currently underway at Sundsvall, one of Sweden's largest ports on the Gulf of Bothnia, for enlarging these rock cisterns for oil storage.

Tidewater Refinery Appointments

Supervisory appointments at Tidewater Oil Co.'s new 130,000-barrel-per-day Delaware Flying "A" refinery, now under construction near Wilmington, Del., have been announced: C. A. Phillips, supervisor of the desulfurizing and hydrogen area; Robert C. Harms, general coordinator of Zone 1; George E. Rohrmann, general coordinator of Zone 3; John J. Dudowicz, electrical coordinator; Samuel E. Roth, instrumentation coordinator; George S. Lee, T. Northcutt, James S. Whitney, and George N. Haines, night superintendents. Dr. Harold E. Achilles has been appointed assistant manufacturing coordinator at the company's New York office.

New Drilling Contractors Head

Jack Abernathy, vice president of Big Chief Drilling Co., Oklahoma City, has been elected president of the American Association of Oilwell Drilling Contractors at its 16th annual meeting in Dallas. J. U. Teague, president, Columbia Drilling Co., Houston, was selected by the board of directors as the national vice president.

Tanker Requirements to Be Studied Worldwide

In response to a request from the Assistant Secretary of the Interior, Walter S. Hallanan, chairman of the National Petroleum Council, has appointed a committee on Petroleum Tanker Requirements. The committee will make a study of petroleum tanker transportation which would include the construction schedule by number and size, U. S. and worldwide, between the present time and 1965, without regard to registry, of all tankers either under construction, on order, or definitely planned, as well as the extent to which ships now on order but not started may be increased in size.

The request for the council's study is the outgrowth of recent meetings of representatives of the petroleum industry with cabinet members, the director of the Office of Defense Mobilization, and other government officials in response to a directive of president Eisenhower to Dr. Arthur S. Flemming directing the latter to consider plans helpful in assuring the efficiency and adequacy of the distribution of petroleum supplies in the foreseeable future in the free world.

Chairman of the new tanker committee is B. Brewster Jennings, board chairman of Socony Mobil Oil Co., Inc., New York. Committee members include Munger T. Ball, Sabine Transportation Co., Inc., Port Arthur, Texas; Gordon Duke, Washington, D.C.; R. G. Follis, Standard Oil Co. of California, San Francisco, Calif. A. E. Herrmann, Texas Independent and Royalty Assn., Amarillo, Texas; W. Alton Jones, Cities Service Co., New York; Augustus C. Long, The Texas Co., New York; D. K. Ludwig, National Bulk Carriers, Inc., New York; M. J. Rathbone, Standard Oil (N.J.), New York; P. S. Spencer, Sinclair Oil Corp., New York; D. T. Staples, Tide Water Associated Oil Co., San Francisco; Henderson Supplee, Jr., The Atlantic Refining Co., Philadelphia; Sidney A. Swensrud, Gulf Oil Corp., Pittsburgh; Reese H. Raylor, Union Oil Co., Los Angeles; Dr. Robert E. Wilson, Standard of Indiana, Chicago; and Robert L. Wood, Independent Petroleum Assn. of America, Midland, Texas.

Indian Government to Build Ammonia Plant

The government of India may go ahead on its own with plans for an ammoniac fertilizer plant.

Burmah-Shell recently withdrew its proposal to set up a plant using waste gases and fuel oils from its refinery at Trombay near Bombay, because the government wanted majority control.

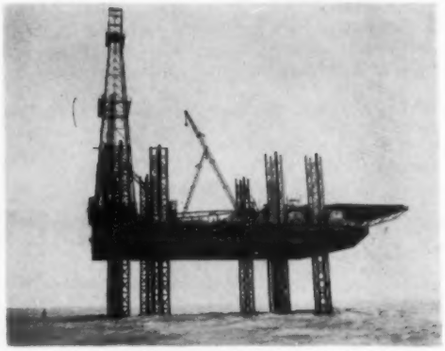
The company, meanwhile, has started marketing bottled gas for domestic fuel consumption from waste gases of the refinery.

Appointments at Williams Bros.

Three new vice presidents have been elected for Williams Bros., worldwide pipeline builders and engineers of Tulsa, Okla. C. M. Collins, formerly executive vice president of Williams Bros. Corp., engineering division of Williams Bros. Co., joined the firm in 1945, and has served in many engineering executive capacities. Emery G. Thiel, a graduate of the University of Illinois and a widely experienced auditor and accountant, was advanced from secretary-treasurer of the firm. He joined Williams Bros. in 1946. Maurice B. Kite, who will also be manager of the general construction division, joined Williams Bros. in 1954 as superintendent of pump-station construction on the Minnesota Pipeline project.

Mine Hazard in Libya

British Petroleum Co. has recently obtained licenses in Libya but mines which were laid in the desert during the war must first be cleared. It has been decided to employ a firm specialising in mine clearance who will use British-type mine detectors and explode the mines as they find them. A helicopter will also be used in the search which began in August.



Atlantic Refining Co. drilling on block 193 No. 1 well 22 miles offshore from Galveston, in 57 feet of water from Offshore Drilling Co.'s No. 55 mobile platform. This rig is capable of drilling to 16,000 feet.

J. E. Heston

R. L. Kidd

ROBERT L. KIDD has been elected president of Cities Service Oil Co., (Del.), with headquarters at Bartlesville, Okla., to succeed the late S. B. Irelan.

In accepting the new post, Mr. Kidd resigned as president of the Arkansas Fuel Oil Corp., with headquarters in Shreveport, Louisiana. He is succeeded in that position by J. E. Heston of Bartlesville, who resigned as vice president of Cities Service Oil Co. (Del.).

New Catalytic Reformer in Sweden

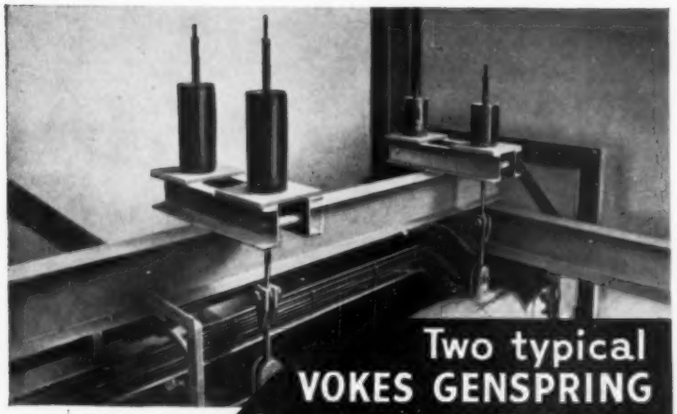
A new catalytic reforming plant at the Koppartrans oil refinery, Goleburg, Sweden, has gone on stream with a capacity of 25,800 b/d.

The plant, which cost about $2 million, has a capacity equal to that of both the thermal plants which had operated previously.

First Udmurt Oil

Deposits of industrial oil have been found on the territory of the Udmurt ASSR between the towns of Sarapul and Kembarka. From one well 1,250 meters (4,125 feet) deep oil "gushed" at the rate of 30 tons per 24 hrs. (about 210 b/d). This is the third oil find in the Udmurt, ASSR. (Moscow Radio 9.8.56).

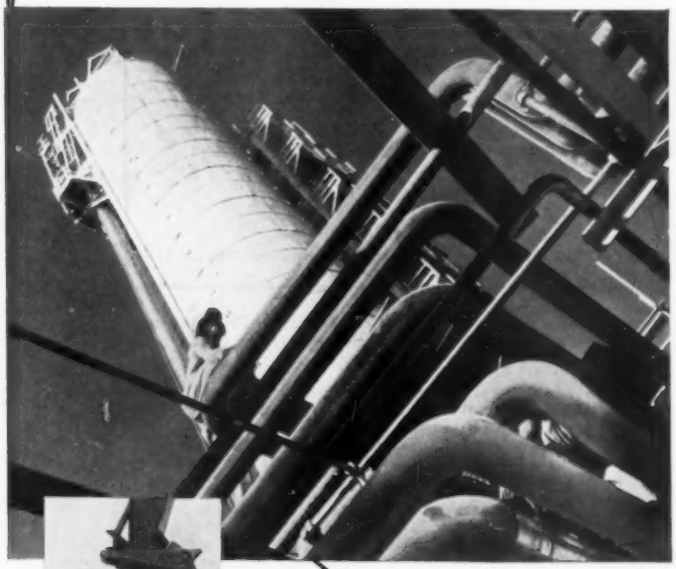
An artist's sketch of the "Gulfhaven," one of Gulf Oil Corp.'s tanker fleet, shows how Gulf's tankers will appear in the future. The traditional colors of black and buff which have been on Gulf's ships since about 1901 have been replaced by blue-gray and off-white. The new Gulf symbol, with the word "Gulf" in an orange disc, will appear on the funnels on the future. Carl F. Vander Clute, general manager of Gulf's marine department, has stated that a distinctive and uniform color combination and simplified tanker maintenance are the principal reasons for the change.



Photograph by courtesy of The Associated Ethyl Company Limited.

Two typical VOKES GENSPRING hanger installations in the oil industry

IN ADEN, The British Petroleum Company's new refinery came on stream in July 1954. Many sections of this complicated process plant piping demand the finest and most accurate suspension methods, and this requirement has been met by the installation of Vokes Genspring Variable Support Hangers. The Associated Ethyl Company Limited have also made use of these Vokes Genspring Hangers at their Ellesmere Port Works in Cheshire.



Photograph by courtesy of The British Petroleum Company Limited.

VOKES GENSPRING Variable Support Hangers are specifically designed for the control of vibration and limited thermal movement of piping, but where piping systems need to be 'floated' to offset the efforts of extensive movement, Vokes Genspring Constant Support Hangers should be used. The full range is detailed in the Vokes Genspring catalogues available on request.

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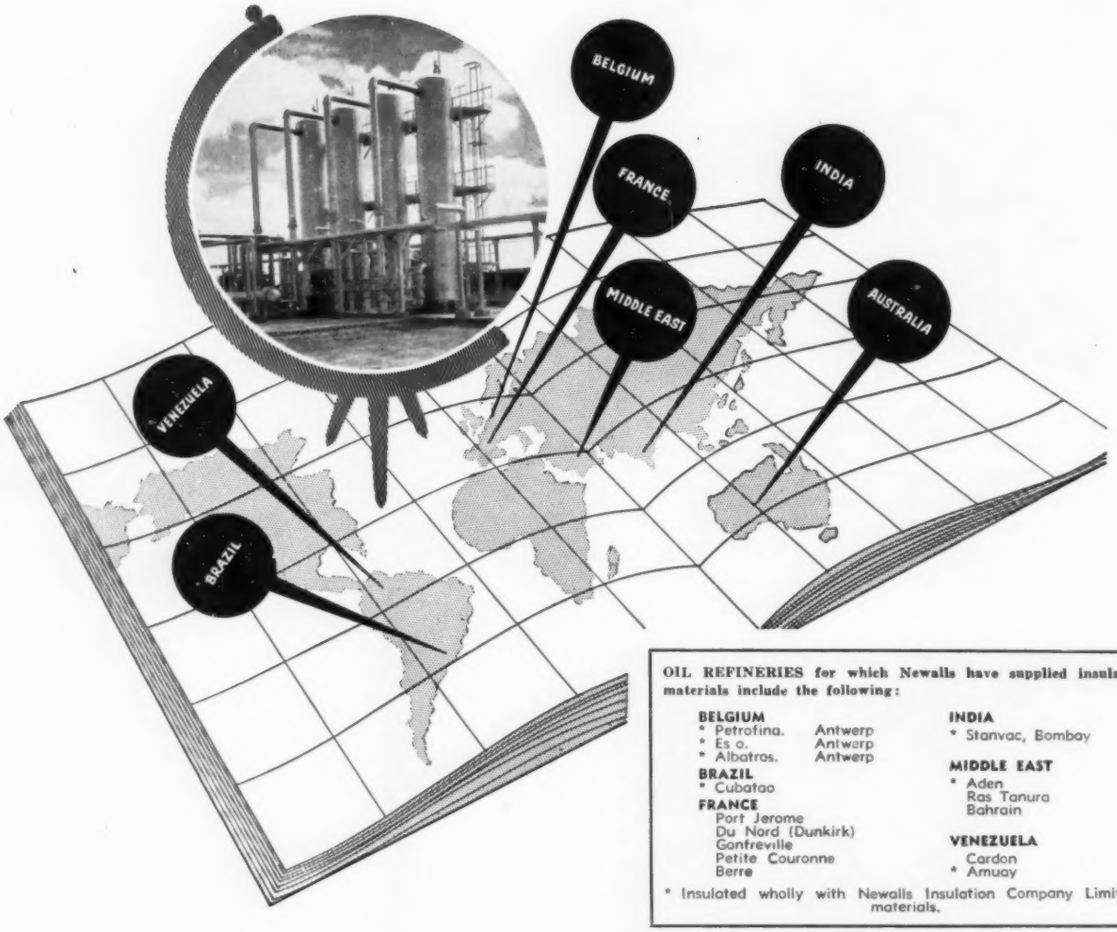

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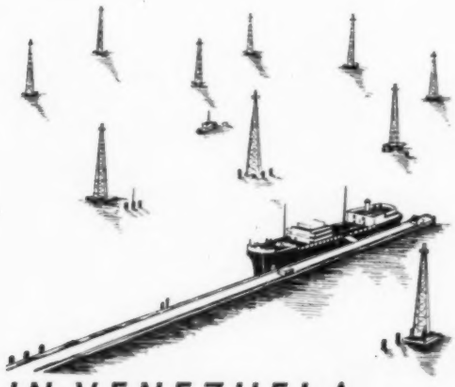

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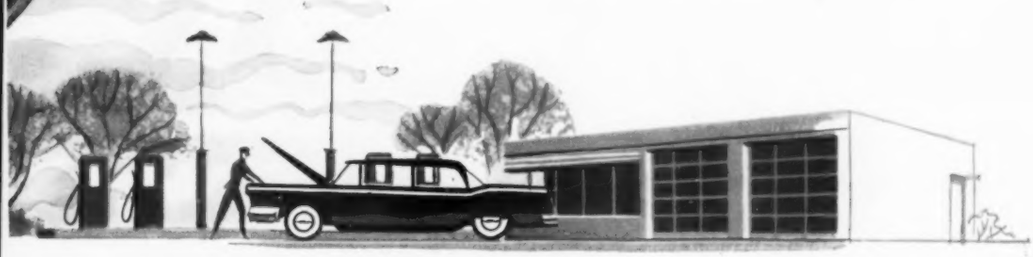
These and other UOP processes, individually or collectively, can provide the answer to most refining problems. We will be glad to tell you how they can help with yours.



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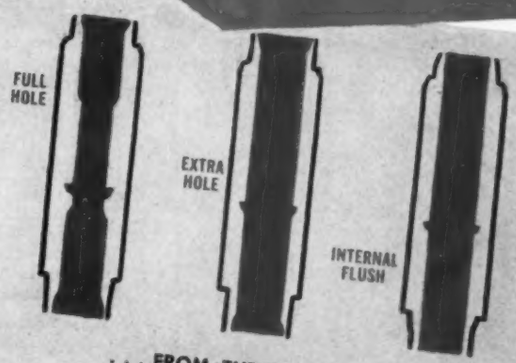

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Oil Compact Delegates Report on Latin American Conservation

At the December meeting of the Interstate Oil Compact Commission in Miami, Fla., Governor George M. Leader (Pennsylvania) said "never in our nation's histroy has the conservation of oil been so necessary. It is the blue-chip stake in the poker game of economic welfare."

John F. Simms, outgoing IOCC chairman and governor of New Mexico, predicted Congress would enact adequate natural-gas legislation, during its forthcoming session, to remedy many of the ills which now beset the oil industry; and emphasized FPC difficulties in determining "fair field prices"—fair to producers, distributors, and pipeliners—with protection of the consumer.

Intelligent conservation of oil means the United States has the petroleum availability now to meet the current world crisis, said H. A. Stewart, director of the Department of the Interior's Oil and Gas Division. With regard to increased production to meet Europe's needs, he said that "the federal government has no intention of asking or even suggesting to any state what its allowance should be or how it should be regulated."

Oscar Chapman, former Interior Secretary, said that, over the long pull, western Europe may be expected to do business with whoever controls the Middle East oil fields, regardless of ideologies. In fact, it has little other choice. The vastness of the Middle East proved oil reserves, estimates of US domestic oil consumption in the future, and the almost total absence of oil reserves in free Europe point up this fact.

Dr. E. L. Cabello, Venezuelan minister of mines and hydrocarbons, said "conservation cannot be reduced to the static level to which some analysts have wished to tie it. It is not the absolute negation of exploitations, or restricted production, by which erroneously the advocates of this theory think to conserve our natural resources."

Paul Charrin

PGAC Sets Record in 1956

Another record for annual volume of business in 1956 was announced recently by Paul Charrin, president of Perforating Guns Atlas Corp., in Houston. The company has completed a new 7,500-sq-ft warehouse and an addition to the building which previously had housed only part of the laboratory and research activities. This permitted PGAC to move the balance of those departments to the new plant during January.

PGAC now employs over 600 persons. Services are also rendered to oil fields in Canada, Venezuela, and Germany, through subsidiary companies in each country. All field equipment is built at PGAC's 10-acre plant in Houston. The company recently celebrated its tenth anniversary.

Hungarian Production Declines

Ernoe Geroe, Hungary's new First Secretary of the Communist Party, has announced a drastic cut in crude production.

Estimates of output in 1956 have been reduced by 320,000 tons. Production of two million metric tons by 1960 was also reduced to 1.9 million tons. Water encroachment was given as the reason.

The first deep well with a depth around 4,000 meters (about 12,000 ft.) is planned in the vicinity of well B-2 near Bazakerettye (Zala region).

New Publications

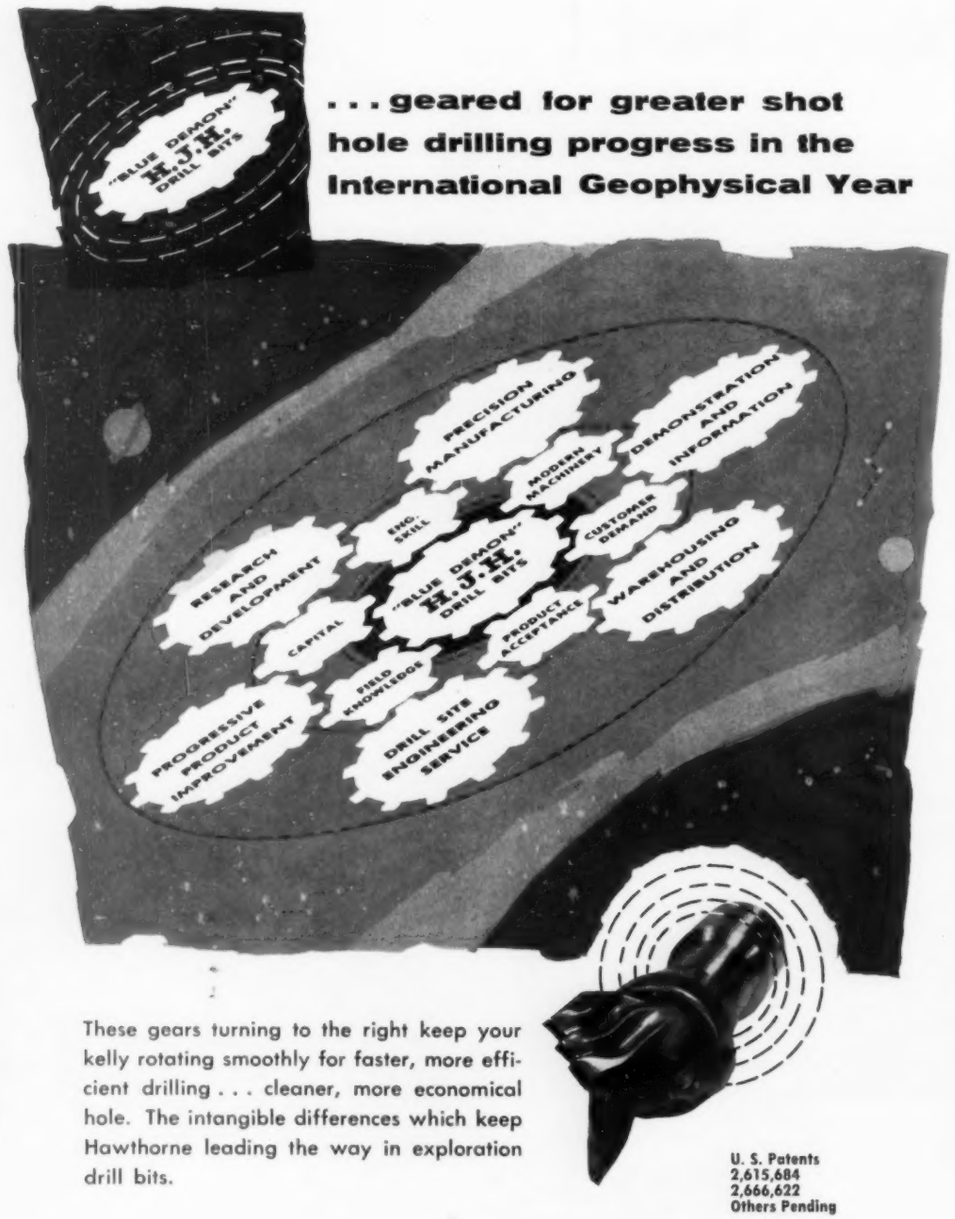
SYMBOLIC LOGIC, BINARY CALCULATION, AND 3C-PACS, a 16-page booklet published (1956) by Computer Control Co., Inc., 92 Broad St., Wellesley 57, Mass., is a primer on the subject of digital computation—designed for technical and nontechnical members of industries and trades; one copy free on application.

BROCHURE NO. 1021 is a new publication on temperature and pressure recorders. It is available from Penn Instruments Division, Burgess-Manning Co., 4110 Haverford Ave., Philadelphia 4, Pa.

THE OUTLOOK FOR THE PETROLEUM INDUSTRY, by Robert E. Wilson; 14-page pamphlet, Standard Oil Co. (Ind.), 910 S. Michigan Ave., Chicago 80 (1956): The Indiana company's board chairman describes some characteristics of the American oil industry as a supplier of energy, as a growth industry, with stable earnings and labor costs, large raw-material reserves, and an advanced science and technology. Among its problems he cites its excess capacity, especially gasoline; imports; and federal natural-gas regulation. Further, he covers the industry's long- and short-term prospects, and the impact of atomic energy.

Supplement No. 1 to TABLES OF CHEMICAL KINETICS, HOMOGENEOUS REACTIONS: published by National Bureau of Standards (1956); 472 pages; $3.25. Available from Superintendent of Documents, US Government Printing Office, Washington 25, D.C. Note: Foreign remittance must be in US exchange, including additional one-third of publication price to cover mailing costs.

ANNUAL PETROLEUM STATEMENT NO. 410: CRUDE PETROLEUM AND PETROLEUM PRODUCTS, 1955 (final summary); published, December 1956, by US Bureau of Mines, Washington, D.C.: These are the final official tables of the salient statistics of the American petroleum industry.



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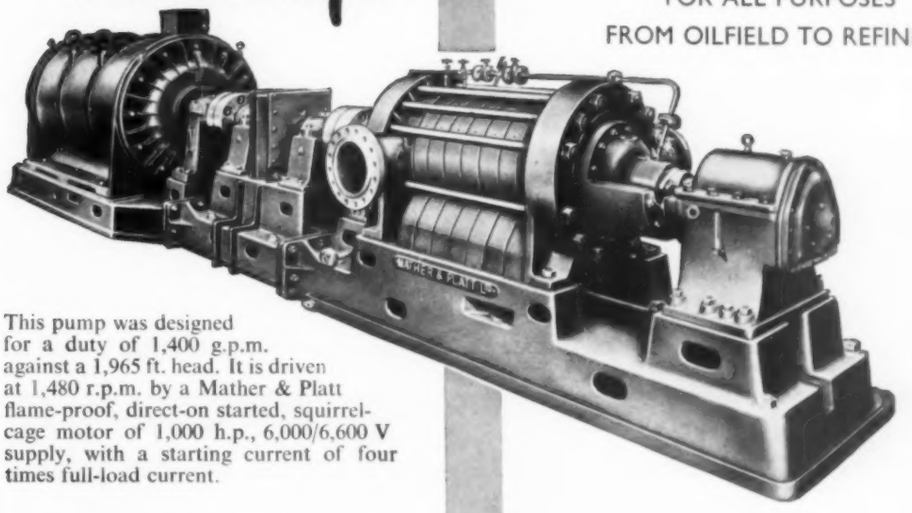
ELECTRIC MOTORS

CENTRIFUGAL PUMPS

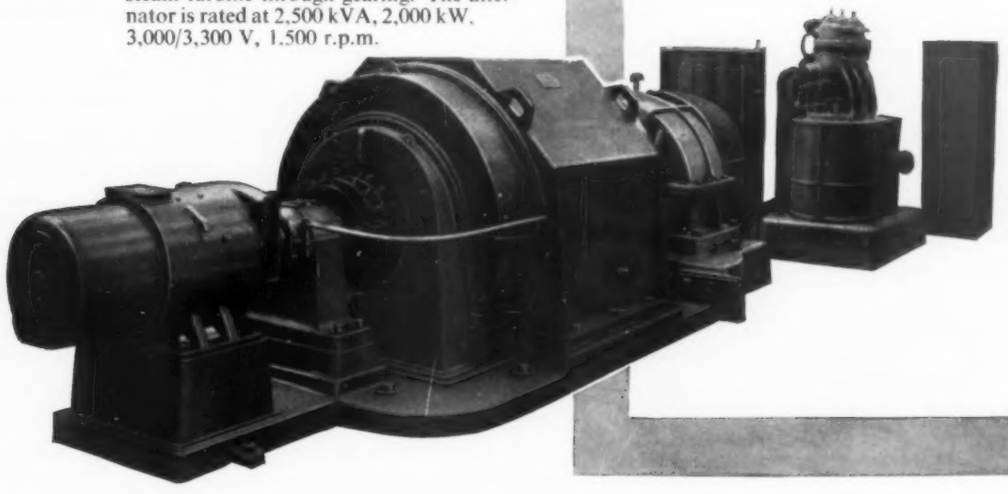
A.C. GENERATORS

FOR ALL PURPOSES
FROM OILFIELD TO REFINERY



This pump was designed for a duty of 1,400 g.p.m. against a 1,965 ft. head. It is driven at 1,480 r.p.m. by a Mather & Platt flame-proof, direct-on started, squirrel-cage motor of 1,000 h.p., 6,000/6,600 V supply, with a starting current of four times full-load current.

A duct-ventilated alternator coupled to a steam turbine through gearing. The alternator is rated at 2,500 kVA, 2,000 kW, 3,000/3,300 V, 1,500 r.p.m.



553

Mather & Platt
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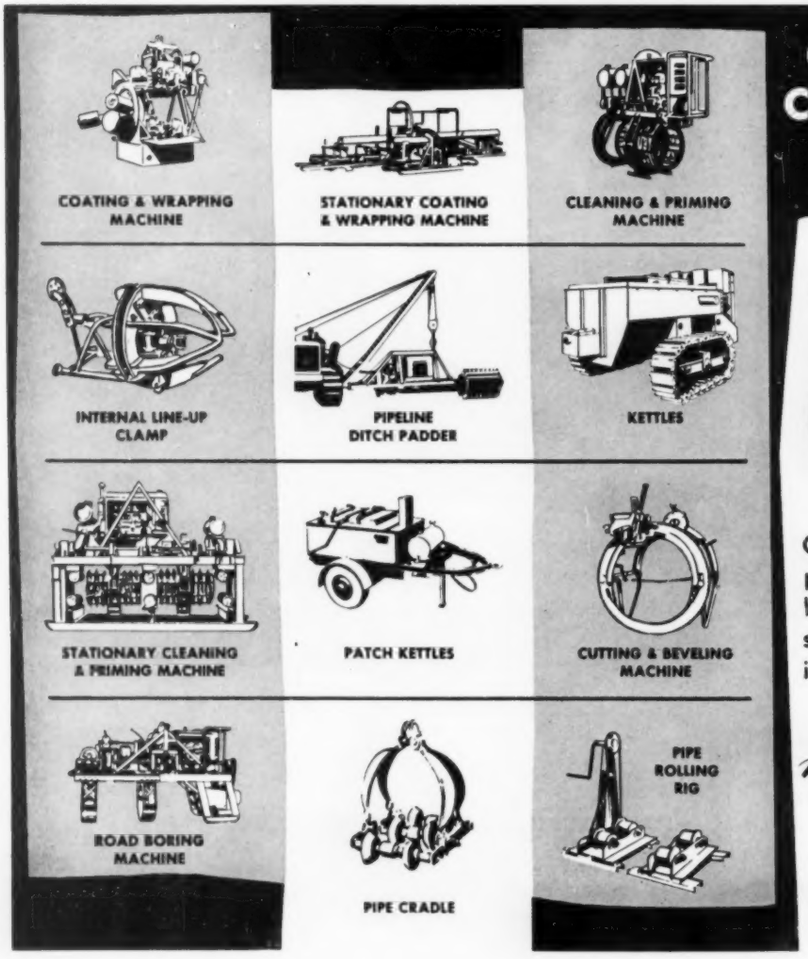
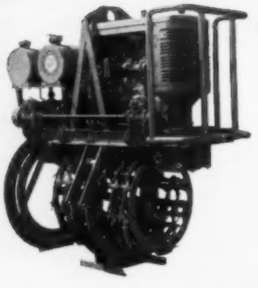


CROSE LINE-TRAVELING CLEANING AND PRIMING MACHINE



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Also can be used with stationary base for yard work. Handles pipe up to 36".

Counter rotating heads assure faster cleaning and priming . . . prevent pipe from turning and give better cleaning job. These Crose machines are specifically designed for faster, trouble-free service on the line.

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Kellogg Solvent Decarbonizing helps refiners get more profitable products from their cat crackers because it squeezes more profitable feedstock from each barrel of crude processed.

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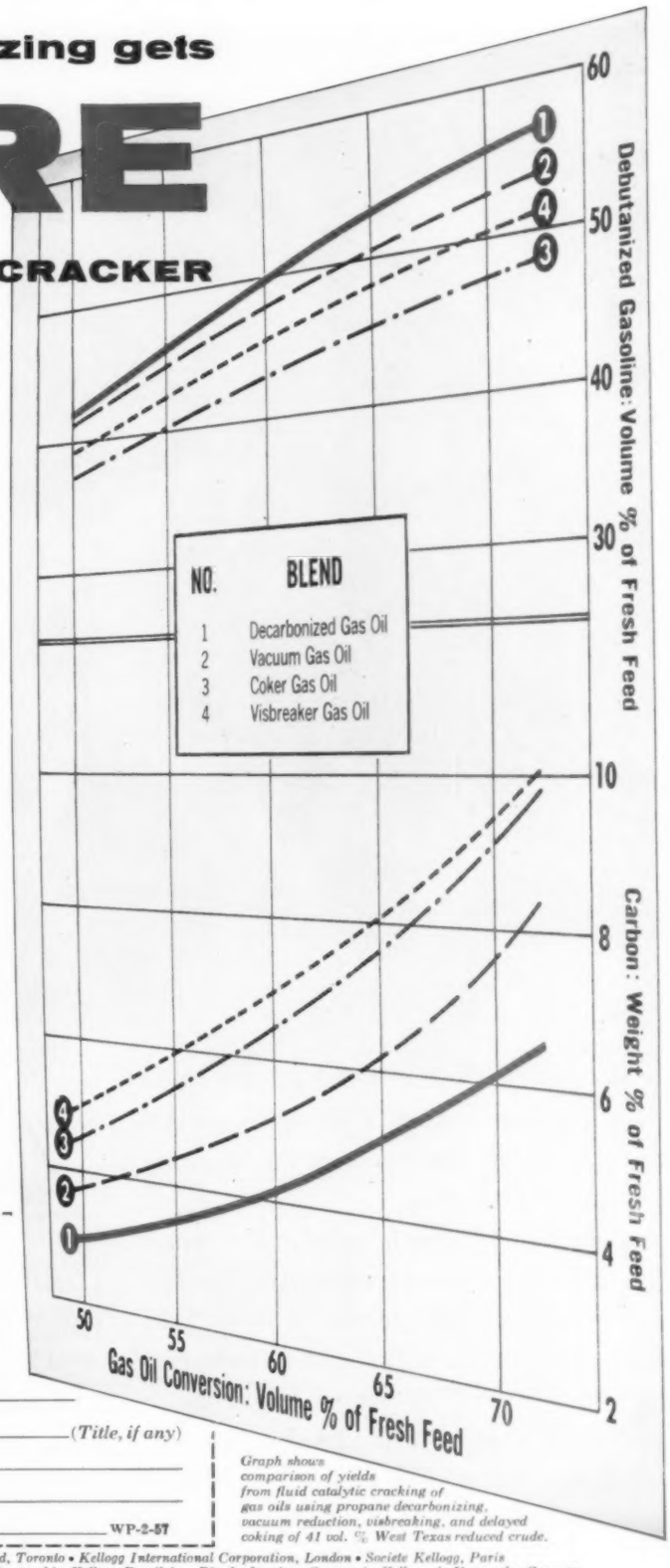

Graph shows comparison of yields from fluid catalytic cracking of gas oils using propane decarbonizing, vacuum reduction, visbreaking, and delayed coking of 41 vol. % West Texas reduced crude.

Refinery Process Division
THE M. W. KELLOGG COMPANY
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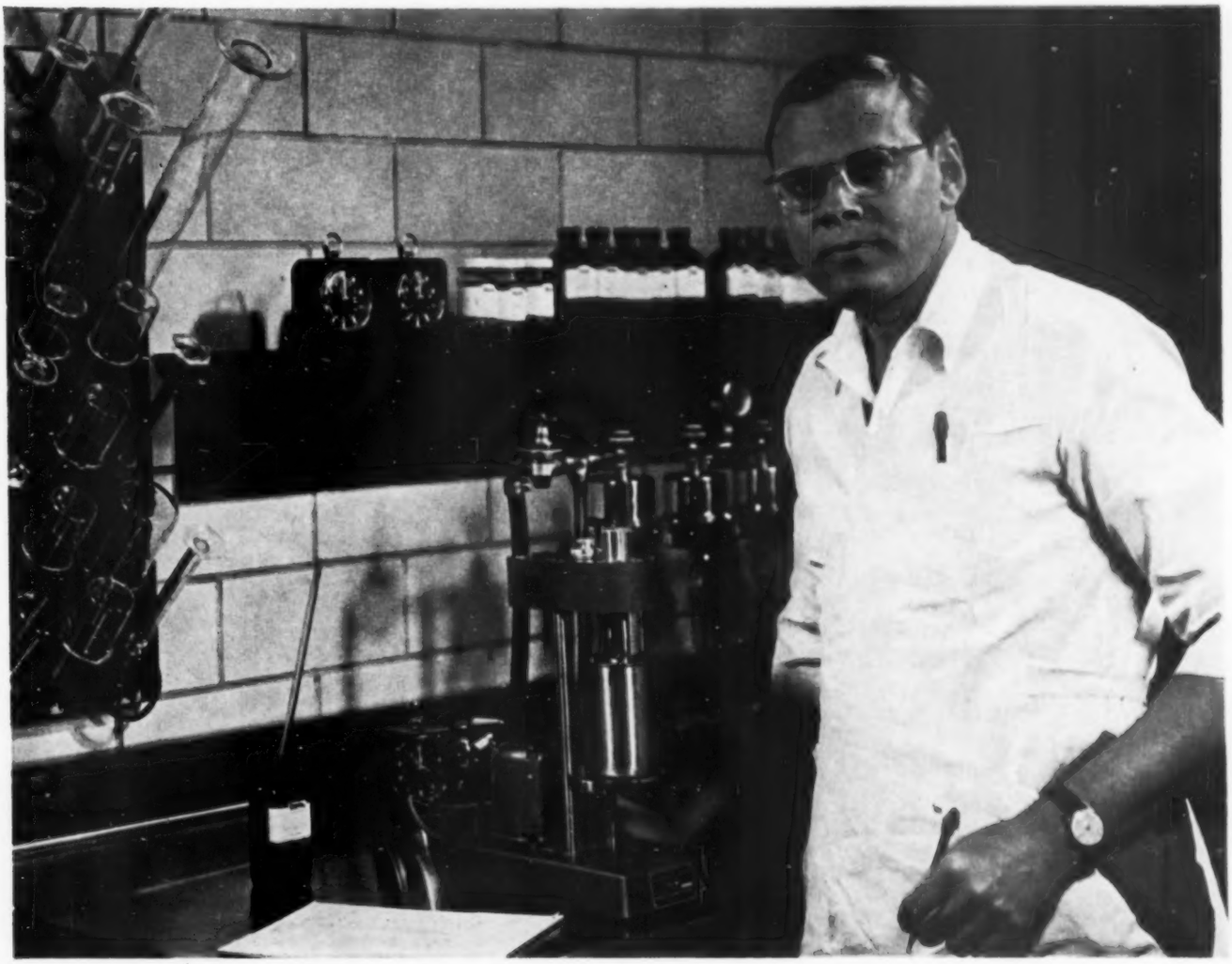
It takes a complete team to keep dependable drilling mud service available for you.



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